Rubber Journal and International Plastics

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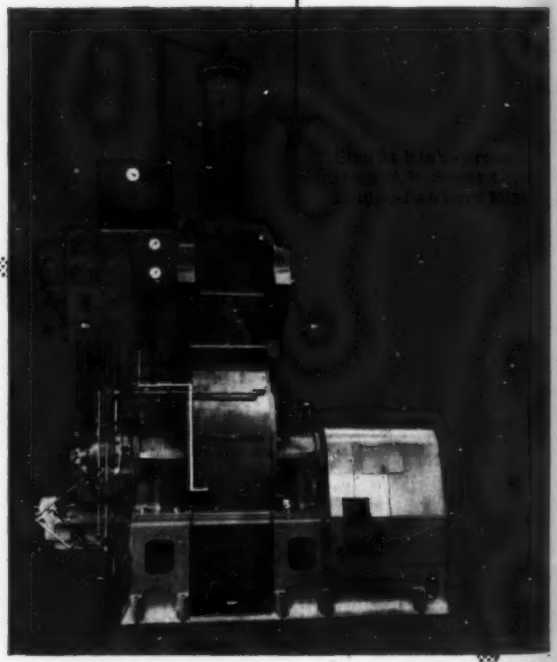

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IN ITS 76th YEAR

October 10 1959

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NOTES of the WEEK

Forty Years

TWO notable fortieth anniversaries have occurred in recent weeks. One of these is the fortieth birthday of the Research Association of British Rubber Manufacturers, which officially came into being in October 1919 in two rooms in University College, London. The current *RABRM Bulletin* contains a message from Mr Alexander Johnston, founder chairman of the association and the prime mover in establishing it. As Dr J. R. Scott, editor of the *Bulletin* and until last year director of research, says: 'It must indeed be gratifying to him to see the present magnitude and firmly established status of the Association as compared with the tentative beginnings and the uncertainties of the 1920s.' Mr Johnston recalls those early days when he was approached by the chairman of the newly instituted DSIR with a view to organizing a research association for the rubber industry in this country. By December 1919, 13 firms had become members. In 1921 premises at Croydon had been found and adapted. The equipment was for a total staff of six and in the first year expenditure totalled £3,230. In this connection it is interesting to note that there is now a staff of 97 and that expenditure last year was very nearly £90,000. Since those early days work at RABRM has indeed most notably progressed. This is not the place to chronicle the Association's activities; suffice to note, apart from all their other manifold activities of such tremendous value to the industry, one aspect of the work of RABRM. We refer to the great number of lectures given by members of the staff to IRI sections, universities, technical colleges and at international conferences. Those scheduled for the immediate future include one by Dr W. F. Watson, director of research, at the International Symposium on Macromolecules, Wiesbaden, Germany, on October 13. Then at the International Rubber Conference in Washington in November Dr W. C. Wake, Dr Scott and Mr A. L. Soden are to give papers.

And Fort(y) More

THE second of the fortieth birthdays mentioned above is that of the *Dunlop Gazette*. Its appearance in July 1919 was typical of the company's progressive approach and, since that time, the *Gazette* has continued to carry out its basic function of keeping those who work with Dunlop in touch with what is happening in all the branches, divisions and sections of the company. It early achieved success and can be accurately described as being always entertaining, instructive and of an excellent professional standard.

Not So Bad

FIRST details of the release of rubber from the US stockpile are out (announced October 2 and reported elsewhere in this issue). The amount quoted, 12,000 tons to be on sale from October 16 for perhaps more than a month, should put at rest the minds of those in Malaya, Indonesia and other rubber-growing areas, who have been making what amount almost to panic pronouncements of the imminent death of the natural rubber-growing industry, and advocating, in Indonesia at least, wholesale switching to alternative crops. It is true, of course, that with the development of isoprene rubber no country with a steady source of crude oil need in the future depend on the rubber tree for its raw rubber. But neither that fact nor stockpile releases will see even the approaching end of the plantations.

Plastics Progress

THE latest Trade and Navigation Accounts show that exports of all plastics materials for the eight months to August 1959 totalled 100,211 tons, which compares with 75,358 tons for the same period last year. Imports for the same period in 1959 were 33,690 tons, against some 24,928. The export figures reflect the fact that sales of plastics materials in the UK have been rising at a notably greater rate than at any time in recent years. Estimates are that the increase may well be of the order of 15% over last year's total sales of 410,000 tons. This would give a total for 1959 of over 470,000 tons. This is a healthy round figure that, however, may well look relatively small by this time next year, for there can be no reasonable doubt that demand will continue to rise. Not so certain, and giving rise to a little perturbation in some quarters, is the question of the supply position or, more accurately, over-supply. However, there remain the optimists, and we are among them, who believe the plastics industry to be on or very near the verge of another great leap forward.

Another Anniversary

YET another anniversary falls this month. This is the first birthday of the International Synthetic Rubber Co. Ltd., which went fully on stream in October of last year. The progress made by ISR in 12 short months is astonishing and speaks volumes for the quality of the now widely familiar Intol products, the efficiency of the plant and the enthusiastic drive of the sales side backed by comprehensive technical service. Intol synthetic rubber, besides meeting steadily increasing UK demand, is now exported to all main world centres. Good going indeed for a one-year-old.

NEWS *Briefs*

LATIN AMERICAN AGREEMENT — DOW PROJECT
INDONESIAN RUBBER — LAND SPEED RECORD
W. GERMAN CHEMICAL TRADE—NEW ZEALAND

●**Germany** — West German foreign trade in chemical goods increased by 14% in the first six months of this year with exports amounting to 2,540m. marks and imports to 941m. marks, according to the German Chemical Industry Association. Exports of chemical goods accounted for 13.4% of total West German exports compared with 12.7% in the same period last year. Their pre-war share was about 17%. Plastics exports were worth 322.5m. marks. 63.5% of the total (1,620m. marks) went to Europe. Those to the partner countries of the European Common Market countries, at 613.5m. marks, increased to 24.1% of the industry's total exports against 23.2% previously, but were below the 26.8% of the total supplied to the seven countries of the Free Trade Area.

●**Uruguay**—The seven Latin American nations meeting in Montevideo to consider the possibility of setting up a Common Market between them have reached agreement on a draft treaty. The draft will now be submitted to the Governments of the seven—Argentina, Bolivia, Brazil, Chile, Paraguay, Peru and Uruguay. Amendments must be submitted before January 15 1960, and a final Foreign Minister's conference to set the project going will be held in the first fortnight of February next year.

●**United Kingdom** — Kuala Muda Rubber Estates Ltd. announces that its estates have been sold, subject to contract and Treasury consent for £536,666, possession of the estates and completion of the sale to be at the end of September 1960. Issued capital is £350,000 in £1 units.

●**Indonesia** — Major brokers in Djakarta are continuing to trade in rubber on a reduced scale but have been refusing to publish export prices since September 26, according to usually reliable trade sources. The decision to keep quotations secret appears to have been taken jointly by a group of firms following the Government announcement that it would export State-owned rubber direct to foreign consumers and cease selling to the local market. However, daily quotations from North Sumatra are being broadcast by Medan Radio. Quotations at the end of September were 28.75 rupiahs per kilo for No. 1 RSS, 27.75 for No. 2 and 26.50 for No. 3, all traded; 27.00 buyer was indicated for No. 1 fine, pale.

●**New Zealand**—Mr Philip Holloway, Minister of Industries and Commerce, has said that increased provision for imports would be among a number of changes in the country's 1960 import licensing schedule to be announced shortly. Mr Holloway told the annual conference of the New Zealand Manufacturers' Association: 'There will be increased provision for importing goods because of New Zealand's improved financial position.'

●**Dominican Republic**—The tyre retreading firm of Planta Recauchado, C. por A., is to buy $100,000 worth of extra equipment. The firm since its formation in 1951 has quadrupled production and last year turned out 23,000 retreads.

●**France** — A multi-million dollar plant for the manufacture of plastics materials will be built in France jointly by Dow Chemical International Ltd. S.A. and Pechiney S.A., a leading French chemical and electrometallurgical concern. The plant will manufacture 'Styron' polystyrene and 'Saran' vinylidene chloride copolymer. The facility will be operated by a newly-formed French company, Plastichimie S.A., jointly owned by Pechiney and Dow. Dow's investments in the company are held by Dow Chemie A.G. in Basel, Switzerland, a subsidiary formed to finance investments overseas. Construction will begin later this year. Start-up of operations is scheduled for 1961.

●**US/UK**—US Industries Inc. have announced that they have purchased for cash the Burtonwood Engineering Company, of Burtonwood, near Warrington. Burtonwood is mainly concerned with the production of oil well equipment, precision machinery for the plastics industry, oil seals, and engine reconditioning.

●**United Kingdom** — A supercharged MG EX-181 broke six world speed records for Class E cars (1,100-1,600c.c.) on October 4 at Bonneville Salt Flats, Utah. Speed for flying mile was 254.53 mph and for the flying kilometre 254.91 mph. Previous figures, set by Italy, were 180.5 and 185.41. The car was fitted with Dunlop track tyres specially designed.

'Well, you see, we don't actually buy sulphur — we get it on National Health prescriptions!'—453

Inventions of the First Rubber Articles

DEVELOPMENTS FROM EARLY TECHNOLOGY

(Continued from October 3 issue, page 282)

By H. SCHURER, Ph.D., F.L.A.

CAVALLO'S statements created a considerable stir as they vindicated Macquer's assertions concerning the ether solvent which Macquer had repeated in the second edition of his *Dictionary of Chemistry*, the first dictionary of its kind. Macquer's critics were silenced by Cavallo. This helped to popularize the dipping process for producing surgical goods from rubber ether solutions.

Two English examples, both dating from 1814, 30 years after Faujas' visit to Cavallo, may be given. While in the first we have to do with rubber-coated surgical textile tubing, the principle was Cavallo's.[10] Fine soft silk was woven round a metal rod. This rod was dipped into a rubber ether solution and after each immersion the coated tube smoothed with a polished stone until a sufficient thickness was obtained.

Du Mênil's Laboratory Tubing

A different method of making laboratory tubing from a rubber ether mixture was proposed by the German chemist A. P. J. du Mênil.[12] He cut rubber into small pieces, pressed those firmly into a glass cylinder, and applied ether. From the resulting mass he rolled a ball and then a cylindrical shape with his hand. The cylindrically shaped rubber mass was then rolled around a conical glass rod utilized like a rolling pin on a pastry board. A hollow rubber tube resulted which could be easily detached from the glass cone rolling pin. While expensive to make, the tubing, according to du Mênil, proved to be very efficient for laboratory purposes. His paper dates from 1824.

Thus, the rubber-ether solvent process had become accepted as the standard method of producing the main application of the new 'Indian rubber,' surgical and laboratory tubing.

Fabbroni's Discovery

While the rubber-ether tubing thus was slowly making its way from 1768 onwards, at quite an early date a young Italian scientist, G. Fabbroni, was experimenting with rubber during a stay in London. He categorically denied Macquer's claim that ether was a solvent and repeated this denial as late as 1791. On the other hand, he had an alternative, a new, rare, and expensive substance, called petroleum or naphtha, which he had discovered in London in 1779 to be the perfect solvent for rubber. Petroleum would evaporate from the rubber solution and leave rubber with all its properties unimpaired.

Fabbroni suggested tubing to be constructed from this rubber solution without specifying any particular method. He had obviously the use of a mould in view as he exhibited a portrait medallion made from his rubber solution with the aid of an unbaked clay mould. While of far-reaching importance, Fabbroni's discovery did not receive the publicity it deserved and had no influence on methods of rubber tube production in any general way.

Fabbroni wrote a brief account of his discoveries for the transactions of a scientific society in Florence in 1791 which were published in the proceedings of that body in 1796.[13] Before that date, soon after Fabbroni making his disclosures in 1791, an Italian fellow scientist contributed some words of information to the French scientific journals.[14] Through these channels the information must have reached a young Scottish medical student of 18 in Edinburgh.

Syme's Contribution

It was left to this youth to make the discovery that signified a tremendous step forward, an efficient rubber solvent that was cheap as well. In March 1818 Syme wrote to the editor of the *Annals of Philosophy*, Dr Thomas Thomson, then Regius professor of chemistry in Glasgow University, informing him of his discovery of a substance from coal tar. The professor was quick to notice the importance of the communication and published it in August 1818.

'As coal tar in every respect bears the strongest resemblance to petroleum, it occurred to me that by distilling it a fluid might be procured which, like naphtha, should have the property of dissolving caoutchouc.'

He described that experiments proved his assumption to be right. Syme was fully aware of the significance of his discovery and concluded his short communication with the prophetic words:

'I may with confidence recommend this fluid as being free from all the disadvantages of the hitherto known solvents of that substance, and I hope that it may be the means of extending its use to the many purposes for which it is so peculiarly well adapted.'[15]

Many years later, some autobiographical notes were incorporated into Syme's biography published in 1874.

Concerning the period under review, Syme wrote: 'After many trials, I completely succeeded and was enabled to carry into effect several of the applications for which a fluid state of India-rubber had seemed so desirable. Thus I constructed flexible tubes of the substance itself. . . .'[16]

Unfortunately, details of the method are not given, but these few words summarize the highest peak of rubber tube construction by means of the solvent process so far reached. The main impact of the discovery was to be in the textile proofing field to which rubber applications shifted once the 'tubing phase' of the nascent rubber industry was left behind.

Bernard's Textile Tubing

The initiative for rubber research in general and for the production of rubber tubing as its first practical result had been inspired by the aim of making solid all-rubber hollow goods. Fresneau's basic idea, realized by Macquer, Fabbroni and Syme with different solvents, had set the model for the first 75 years of investigations. Fresneau, in his turn, had adopted the primitive rubber technology of the Amazon Valley. However, since the beginning of the 17th century a second rubber technology had been flourishing in America, that of the latex proofing of textiles. This rival technology was bound to find its imitators in Europe sooner or later. When submitting his statement in 1763, Fresneau had enclosed a piece of latex-coated tubing brought by him to France from America.

For this purpose, too, man-made

latex, derived from rubber bottles, had to take the place of natural latex, but the problem was not quite so difficult as that of the production of solid rubber goods. Together with the latex-proofed piece of tubing, Fresneau had enclosed a piece of cloth proofed with rubber turpentine solution.

In the production of tubing, however, drying oils appear to have been used as solvents. The best known rubber-proofed textile surgical tubing was invented by the Parisian goldsmith, Bernard. At the beginning of 1779, the first version of this tubing received the approval of the French Academy of Surgery.[17] An improved type was highly recommended by the French Royal Society of Medicine in 1781.[18]

The name of Macquer appears among the signatures of the favourable report. Whether or not influenced by Theden, the new version of the Bernard tubing consisted of a fine silver spiral wire covered with silk tubing coated on both sides with rubber solution. The advantages of Bernard's tubing were its great flexibility allowing freedom of movement, its chemical resistance to the liquids passing through, and its resistance to boiling water. Bernard's surgical tubing made a considerable stir and was frequently referred to in the literature at the time.

Later, criticism was levelled at its performance. It was said that the coating tended to flake off and this would make the tubing useless for its purpose. While generally described as rubber tubing, it was only textile tubing with a special coating and naturally lacked the elasticity of real rubber tubing which was far superior for this particular purpose. That was the line the critics took.[19]

Direct Utilization of Latex for Tubing

The foundation of modern rubber science can be defined as the challenge presented by the non-availability of latex in Europe. Once the challenge had been responded to by Macquer and a serious study of the properties of the mysterious *caoutchouc* got under way, European scientists having access to latex in America and Asia utilized the achievements of rubber science to raise the direct application of latex to a more advanced level than had hitherto been reached.

Tubes from the Tree

On the simplest level, there is the story that at the beginning of the 18th century a Portuguese surgeon living in Brazil had noticed latex coagulating round a branch to form fine tubing and had been inspired to use this natural tubing for catheters.[20] This was only related as a rumour in the 19th century and does not impinge on Hêrissant's unchallenged priority with his rubber catheter idea. It was exactly because the European scientist could not pluck his rubber tubing from the nearest tree that he was forced to make his knowledge bear on the subject and in the long run got much further than the man on the spot.

Cervantes' Process

More interesting is the fact that Cavallo's dipping process was suggested in connexion with *Castilloa elastica* latex by a Spanish scientist resident in Mexico. Wax- or clay-coated wooden formers were advocated by the inventor, Vicente Cervantes, about 10 years after Cavallo had shown his tubes to Faujas. As the French visitor's account had not been published by the time Cervantes gave his lecture in 1794, the Spaniard must be given credit for having arrived at the dipping method quite independently. Cervantes was out for mass production: by suspending many formers from a ring as many tubes could be produced at the same time.[21]

Howison's Experiments

Almost at the same time as Cervantes described his dipping process, a British scientist, studying *Urceola elastica* latex in Asia, tried to improve on the results hitherto obtained in Europe with rubber solutions in the production of solid rubber bougies. Possibly his experiments found some resonance in England. James Howison wrote as follows:

'Having observed that most of the patent catheters and bougies made with a solution of the elastic gum, whether in ether or in the essential oils, had either a disagreeable stickiness, or were too hard to admit of any advantage being derived from the elasticity of the gum, I was induced to make some experiments with the milk (of *Urceola elastica*. H.S.) towards removing these objections.

'From that fluid, by evaporation, I made several large-sized bougies of pure gum, which, from their over-flexibility, were totally useless. I then took some slips of fine cloth covered with the gum, which I rolled up until of a proper size, and which I rendered solid by soaking them in the milk, and then drying them. These possessed more firmness than the former, but in no degree sufficient for the purpose intended. Pieces of strong catgut, coated with the gum, I found to answer better than either.'[22]

Ingenhousz' Discovery

While all the developments described up to now can be traced back to the influence of primitive indigenous rubber technology, a completely new departure was made as early as 1779 by an eminent Dutch physician resident in England, John Ingenhousz.

His is the first *published* statement of the observation on which the mechanical processing of rubber is based. While Fresneau was the very first in the field, his remarks remained unpublished and were dictated to such an extent by the conviction that any process but the solvent process was an inferior *ersatz* that they failed to impress the few people who had seen his manuscripts.

Fresneau, too, apparently overestimated the part of simultaneous heat treatment when 'soldering' or 'welding' his little pieces of rubber together to form a tube.

Ingenhousz' statement is much more precise and to the point. He adds the new idea of building up a tube from a rubber spiral. His few words form the basis of a completely new approach.

'Instead of a glass bottle I often use an elastic gum bottle, or caoutchouc, and instead of a bended glass tube, I take one made of the same elastic gum. Such tube is easily made by coiling up pieces of caoutchouc bottles in the form of tubes and sticking them together by their extremities. This wonderful substance possesses a strong power of attraction for itself, so that two pieces cut with a sharp instrument will adhere strongly together if joined before the cut and smooth edges have been touched by the fingers, or before they are soiled in any way.'[23]

References to rubber tubing made in this way being used in his experimentation can be found in Ingenhousz' writings. He was the first to emphasize the advantages to be derived from rubber laboratory tubing, owing to the chemical resistance and elasticity of the substance.[24]

Grossart's Success

Ingenhousz' few lines, tucked away in a substantial book on experiments on vegetables, were not noticed much at the time. His method of tube manufacture was generally ascribed to a French scientist, Grossart, who probably had hit on the same idea quite independently from Ingenhousz.

Grossart published his paper in 1791.[19] He used a glass former round which he wound a rubber spiral. However, by emphasizing the importance of simultaneous heat treatment, Grossart's exposition gave rise to the idea that rubber could be welded and soldered in the same way as metal and that the heat softening was the all

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important part of the solventless method.

This was the same idea Fresneau had held before him, while Ingenhousz' few lines are much clearer on this point. Grossart's paper created quite an impression; it was twice translated in full into English,[26] and even James Watt, of steam engine fame, took an interest in the Grossart method.[27] For personal reasons, Watt studied the therapeutic uses of gas inhalation and warmly recommended tubing made by the Grossart process as suitable for the inhalation equipment.

The great advantage of Grossart's (or really Ingenhousz') method was its saving of the prohibitively priced ether solvent.

An original adaptation of the Ingenhousz–Grossart method, which rather resembles the mutual adhesion process of Fresneau, was proposed by an anonymous correspondent in 1805 in a letter to the *Philosophical Magazine*.

He, too, wanted to avoid the expense of ether. Split a cane, he suggested, and then put it together again, with a slip of whalebone interposed. Pieces of rubber were pressed together over the cane, then the piece of whalebone removed, and the two halves of the cane extracted. Heat treatment had been applied to unite the pieces of rubber. After removal of the cane a rubber tube remained.[28]

Such methods encountered scepticism in certain quarters. In the correspondence column of the *Annals of Philosophy* of 1814 an engineer asked 'How are elastic gum bougies formed? Not certainly by welding one longitudinal strip to another as is represented.'[29] The editor had no information to offer.

That the Ingenhousz–Grossart method had caught on is shown by the Skidmore method of making blow pipes. Skidmore, an American, combined the rubber spiral process with Theden's feature of a metallic spiral reinforcement.[30] His proposal dates from 1822.

In 1825 H. B. Leeson read a paper to the Nottingham Literary and Scientific Society which repeated the Grossart process with only very minor modifications. His tubing was passed round the audience and, to everybody's satisfaction, appeared to have the same elastic properties as the rubber bottles imported from America.[31]

Hancock's Contribution

Meanwhile, in 1820, Thomas Hancock had been the first to see the general implications of the mutual adhesion of freshly cut rubber, as noted by Fresneau, Ingenhousz and Grossart. His construction of the masticator to reduce rubber to a workable shape, to turn the rubber bottles into rubber 'ingots,' as they were then called, was the result of this idea.

The solvent process was superseded by the mechanical processing of rubber as the main feature of the nascent rubber industry as far as the production of solid goods was concerned. After being the one important rubber article, tubing became one of many; the pioneer period was to some extent past. Once the masticator could turn out rubber ingots which in their turn could be turned into cut sheets, the production of tubing became much facilitated.

Tubing from Cut Sheet

The principle was still that of Fresneau, Ingenhousz and Grossart, but between the original rubber bottle and the final product the masticator was now interposed. The new process of tube manufacture was described as early as 1824, but the vital stage of masticator treatment was then strictly kept a secret. The tremendous importance Fresneau and Grossart had ascribed to simultaneous heat treatment was put into proper perspective. The lesson which Theden's spiral reinforcements had taught, had not been forgotten.

This is how an anonymous note described Hancock's method of tube manufacture from cut sheet, almost in the words used by Ingenhousz half a century earlier:

'Recent sections made with a sharp knife or scissors when brought together and pressed, adhere so firmly as to resist rupture as strongly as any other part, so that if two sheets be laid together and cut round, the mere act of cutting joins the edges and a little pressure on them makes a perfect bag of one piece of substance. The adhesion of the substance in those parts where it is not required is entirely prevented by rubbing them with a little flour or other substance in fine powder. In this way flexible tube catheters, etc., are prepared. The tubes being intended for experiments on gases and where occasion might require they should sustain considerable internal pressure are made double and have a piece of twine twisted spirally round between the two. This, therefore, is embedded in the caoutchouc, and at the same time that it allows of any extension in length of the tube, prevents its expanding laterally.'[32]

Conclusion

A cynic might have been amused by the sobering fact that for the first 75 years of the career of rubber in Europe no greater contrast between expectations and actual achievement could be imagined. Scientists, great statesmen, scholars of many nationalities drew up glowing lists of applications for which the startling properties of the new substance made it suitable —yet, in practice, no other solid rubber goods were realized but some catheters and some bits of laboratory tubing. All the same, these first 75 years stimulated investigation, fired the scientific imagination of some of the best brains, and led to striking results in the search for solvents and the mechanical processing of rubber.

It has not been an easy way for the substance to be acclimatized to European industry. If ever a substance has risen from very humble beginnings to an important position in life, rubber is a case in point. It is to the credit of 18th century chemistry that it rose triumphantly to the challenge presented to it by the elastic resin of French Guiana.

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Export Issue

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Electrical Aids in Industry *Data Sheet* **No.7**

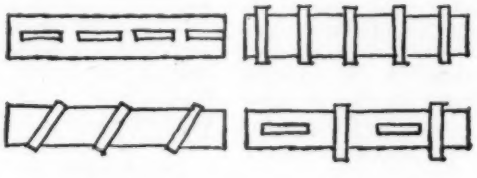
Lighting-2

The general principles of factory lighting have been dealt with in the previous data sheet (No. 6). This one considers briefly certain factors—not always fully appreciated — that influence the lighting for some particular factory applications. The next data sheet will carry the subject further.

Work benches

The most universal application of lighting is to bench work, for there is no branch of manufacturing that does not have its work benches which, of necessity, are used for a great variety of occupations. No single lighting method is suitable for all cases.

The introduction of fluorescent lighting has gone a long way to solving one of the main problems here; for while the high degree of brightness of filament lamps tends to preclude their use for individual lighting owing to the glare, the fluorescent tube with its greater expanse of light source has made localised lighting with a low mounting height more practicable. Moreover, the length of the fluorescent tube puts into the hands of the designer a means of controlling shadows which, together with glare, probably represent the most prolific causes of errors and eye-strain.



With narrow individual benches (not more than 4 ft. wide), there are four basic methods of localised lighting: longitudinal, transverse, diagonal or a combination of longitudinal and transverse. With wider benches it is not advisable to use fittings directly over benches, and fittings should be behind the workers at each edge of the bench. Where particularly high illumination is required, fluorescent fittings may be mounted as local lights—low enough for the skirt of the reflector to conceal the lamps from the eye of the operator.

It is good practice to use reflectors which allow a reasonable amount of light to spill upwards, giving a certain amount of general lighting.

High-bay shops

Probably the most difficult of all factory lighting problems is that of high-bay lighting. In lofty, long and sometimes necessarily dirty shops such as those which house really large machine tools and overhead cranes, which do their worst to defy the efforts of the illuminating engineer, it requires great ingenuity, coupled frequently with high lamp wattage, to provide the workman with enough light to allow him to do his job efficiently. From the planer operator to the slinger, the workman, though he may not know it, is dependent on good lighting if he is to avoid an over-cut or a serious crane mishap.

The major problems associated with the lighting of high and relatively narrow shops, such as heavy machine shops and foundries, are :—

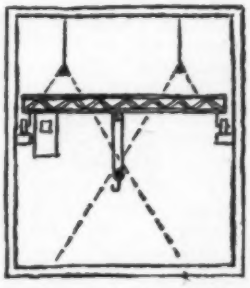
(a) Poor light utilisation caused by excessive light absorption by the large and often dark wall area.

(b) Preponderance of light flux downwards and poor cross lighting causing poor illumination on vertical surfaces, and heavy shadows.

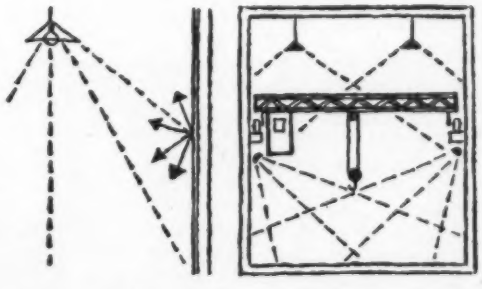
(c) Possibility of heavy light absorption in the atmosphere.

(d) Difficulty of access to high fittings for maintenance.

In high-bay workshops there is a tendency to use concentrating fittings so that the maximum proportion of the light output reaches the working area without spread to the walls, but the saving in wall absorption is obtained only by accepting a depressing environment, poor cross lighting and heavy shadows.



In many cases it is good practice to accept the inevitable reduction in light utilisation by wall absorption and to reduce this by applying light colours to interior surfaces where possible throughout. This approach results in more cheerful conditions and provides equally good illumination values and better cross lighting. Even better is to add angled lighting from the sides below crane level.



In the conditions obtaining in this type of shop, rapid deterioration in light source intensity due to dust must be expected. Facilities should always be provided for easy access to fittings for cleaning and maintenance.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. Telephone: TEMple Bar 9434.

Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available—"Lighting in Industry" is an example.

E.D.A. also have available on free loan in the United Kingdom a series of films on the industrial uses of electricity, including one on industrial lighting. Ask for a catalogue.

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Advertiser's Announcement

Pattern-Making in Plastics

1. INTRODUCTION — PATTERNS AND MOULDS

By H. G. KING*

Summary

The introduction of plastics as a material for the manufacture of foundry patterns has opened a wide field for interesting development. For the past three years the possibilities of using this type of pattern in the iron, steel, and brass foundries have been investigated and developed in the Crewe Locomotive Works, by the author. After initial difficulties and trials with various types of resins and materials, the use of plastics has increased with such outstanding success, in both the pattern shop and the foundries, that pattern-making in plastics has been established and is now a recognised method of manufacture. As a result of the research into the use of this material, there are now over two thousand plastic patterns in use on moulding machines of various types, and these notes will illustrate the advantages that have been found to accrue from this comparatively new practice. The resins used in the manufacture of the patterns considered in this paper are the product of one particular firm; the formulas quoted are peculiar to these products and are not of a universal nature.

IN the iron, steel and brass foundries of today there is an enormous demand for high quality pattern equipment for machine moulding, and pattern-makers are called upon to produce patterns to suit widely differing methods and conditions of casting production. The pattern-maker has at his disposal a considerable variety of materials from which to choose the one best suited to the foundry requirements. Of timbers, yellow pine and mahogany are widely used, and for metal patterns, cast iron, brass, and aluminium all have their established places in the foundry. These materials have been used for many years, and we have become accustomed to accept, not only the many advantages of patterns made from these materials, but also to accept their shortcomings. For instance, timber patterns which are comparatively cheap can be successfully used for short production runs, but, no matter how well made, the association with warm and damp sand will soon cause the material to swell and troubles follow with its lack of stability.

A good metal pattern will produce many thousands of moulds without attention. No one, I feel sure, will dispute the value of a good quality cast iron pattern in continuous use. It will withstand the abrasion of sand, in fact, to some extent become polished and its performance improved. Aluminium patterns also hold a favoured place in the foundry, either in the form of sand cast patterns, or the more modern pressure cast plates. For long continuous runs such equipment has much to commend it, but comparatively few foundries are in the happy position to establish machines for such continuous production, one more often sees the intermittent use of patterns, the completion, or part completion of an order followed by a period of storage. This applies in particular to the foundries of British Railways, and no doubt to many others, and so that polished surface of the metal pattern soon disappears, cast iron patterns become rusted and pitted, aluminium patterns corrode, and wooden patterns perhaps suffer the most during the period of storage.

There has now been added to that list of pattern-making materials one which, whilst possessing most of the advantages of the established materials, has none of the aforementioned disadavantages *i.e.* epoxy resin. Patterns made in this material possess a surface of outstanding quality. It is an understatement to claim that an epoxy compares favourably with the best of patterns made from any other material. This surface is maintained in spite of most unfavourable storage conditions. There is no grain to swell, there is no rust and no corrosion to give concern, thus maintenance costs are much reduced. A plastic pattern can be taken from storage and the surface will be exactly as it was when the pattern produced its last mould.

Its use on jolt squeeze machines, plastic patterns, particularly if of laminated structure, have proved to be very durable indeed. Patterns are in use in the foundries of the Crewe Locomotive Works, which have produced many thousands of moulds without repair, and whilst these patterns may not possess the glamorous appearance of new patterns, they are still dimensionally accurate, and wear, if any, so slight that it cannot be measured by the normal tools of a pattern-maker. Not isolated patterns of simple design, but, patterns in considerable variety individually have produced many thousands of high quality moulds.

May I offer some proof of this claim. About two years ago, three moulding machines using pattern plates 15in. x 12in. were replaced in the Crewe Locomotive Works Iron Foundry by a semi-mechanized unit consisting of a pair of jolt squeeze machines with pattern plates size 24in. x 18in. The equipment consists of one roll over and one pin lift machine simultaneously producing moulds with gravity conveyor to coring, closing, casting and knockout.

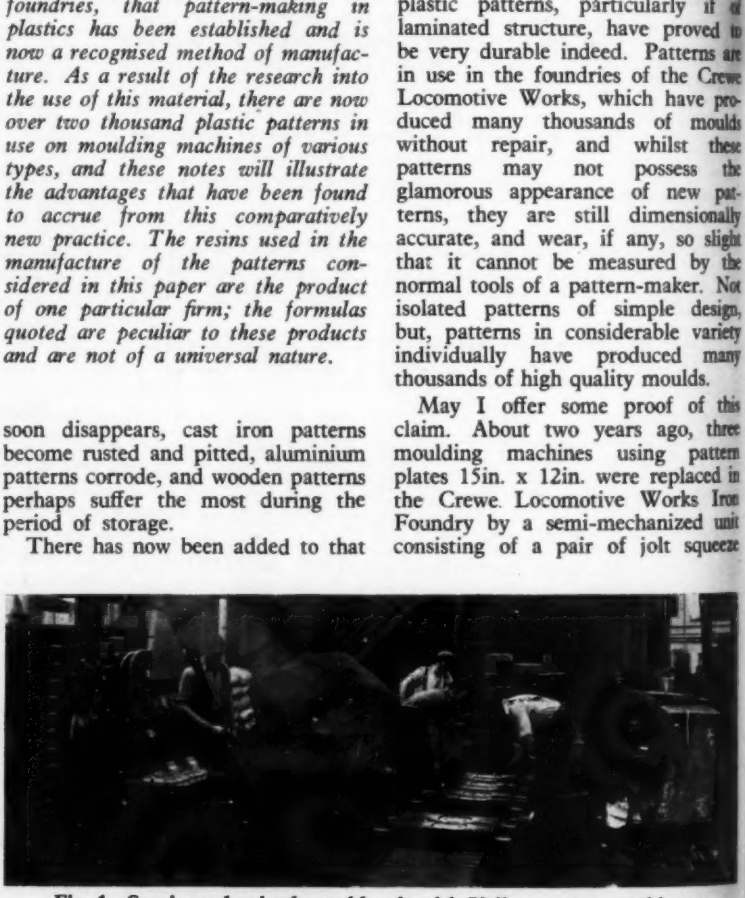

Fig. 1—Semi-mechanized mould unit with 70 lb. squeeze machines

*Of the British Railways' Locomotive Works, Crewe.

This paper, which was originally given to the Birmingham Branch of the Institute of British Foundrymen, has been revised to take into consideration new materials and techniques.

points. This plant is illustrated in Fig. 1.

The original moulding machines were served by approximately 800 cast iron plates with metal patterns, and it will be appreciated that this change from the small to the larger plates involved the manufacture of a considerable amount of new pattern equipment. Not only were the existing patterns insufficient in number, due to the use of larger plates but the condition and quality of these patterns were not to the standard required. Casting orders vary from 50 to 5,000 off, and it is evident that if conventional wood and metal patterns were to be made there would be considerable delay before the production of the larger orders, which would require metal equipment, could be contemplated.

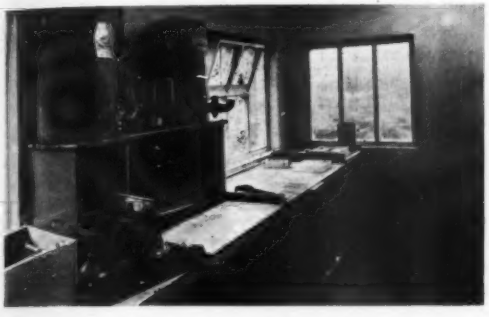

Fig. 2.—The extension of the Crewe Locomotive Works pattern shop

By this time we had been able to prove the durability of plastic patterns, and a careful survey of records of plastic patterns used on other machines gave a very satisfactory picture. Costs were considered in detail, and, although there would be some additional expense in providing plastic patterns where wood could be used for smaller orders the considerable saving effected by using plastics instead of metal provided a very attractive overall economy. The decision was eventually made to embark upon an extensive programme of plastic pattern manufacture to serve this new unit, and within a short time machines were in production.

For the first few months it was difficult to maintain continuous production. Pattern plates which had taken from one to two weeks to produce provided only a few hours work for this new unit, but on no occasion was production delayed due to non-delivery of pattern. The plant is now well established producing high quality castings in considerable quantity from pattern equipment consisting of well over 300 machine plates, 95% of which carry plastic patterns. This unit of production has undoubtedly provided an ideal opportunity to prove the worth of plastic patterns, and, I feel sure that the trouble-free running of this plant owes at least something to the plastics pattern equipment. This unit does not by any means complete the story. In this same foundry, another larger unit, consisting of two roll over machines with moulding boxes 46in. x 32in., provided the opportunity to produce much larger patterns, and many plastic patterns are now giving excellent service on this unit.

In the Brass Foundry two small pin lift machines are using well over 300 plates of plastic patterns, and the last few months has seen the introduction of plastics into the Steel Foundry where patterns, mostly of laminated structure are standing up to the heavy use one finds in a steel foundry, with every success.

Materials and Equipment Required

The materials required for the manufacture of plastic patterns are readily obtainable, and can be used with complete success without a knowledge of chemistry. This statement, I think, reflects credit to the industrial chemist, who, after some initial difficulties and misunderstanding, has now produced materials of outstanding quality. A standard casting mix consists of three main ingredients, an Epoxy Resin, a filler, and a hardening agent.

Epoxy Resin.—This is supplied by the manufacturer in syrup form, and providing it is stored and used in a normal room temperature, is of fairly low viscosity which permits the easy mixing of filler and will allow air, introduced during mixing to escape.

Fillers.—Marble flour and powdered slate are ideal fillers, and are chosen to impart certain properties to the cast, *e.g.* slate will produce a cast of very hard surface, and is useful for core box manufacture where the plastic surface has to withstand the wear of trowelling. For general machine patterns marble flour is entirely satisfactory, giving a surface hard enough to withstand the abrasion of sand, yet can be sandpapered and polished without difficulty.

Hardening agents.—The addition of hardening agents will transform the mix of resin and filler into a solid. Three hardening agents are available, a fast hardener for very thin casts, one of medium speed for casts up to one inch thickness, and a slow hardener for casts above this thickness. The hardening agents used are in the form of hardener modifiers, and the inclusion of the modifier has done much to give castings free from brittleness.

In addition to these materials stocks of the following will be needed.

Thixotropic agent.—This is used to transform a casting mix into a paste which can be spread over a mould surface and remain in position on all surfaces, including the vertical, without flow. The addition of this Thixotropic agent is not an easy operation, and it is somewhat difficult

Fig. 3.—A master pattern surrounded by a wooden frame. The machining allowance is clearly shown

to estimate the correct amount required to give the necessary property. As an alternative it is now possible to obtain a prepared Epoxy resin in paste form which is fully thixotropic, and the use of this new material is recommended.

Fibre-glass fabrics.—After impregnating with a special resin mix this material is built behind the facing coat in the form of laminations. There are many suitable varieties of fibreglass material, but a fabric of loose weave about 10 thou. thickness is easy to impregnate, and will readily take the form of the mould shape. For large patterns fibreglass matting of 1oz. weight well impregnated with resin will produce a laminate of incredible strength.

Cork.—In block form this is used extensively as a core material associated with a shell casting technique.

Vermiculite.—Industrial grade vermiculite impregnated with epoxy resin is used as a lining to give additional rigidity to large laminated patterns.

Plaster. — Plaster is an ideal material for mould manufacture, and should be of low expansion type.

Sealing lacquer.—As epoxy resin post curing of plastic patterns. For small work an oven built of sheet metal secured to a light framework, about 4ft. long by 2ft. 6in. wide by 2ft. 6in. deep will be satisfactory. For convenience shelving should be adjustable, and the heating element built into the base. For an oven of this capacity five tubular heaters 4ft. long with a loading of 80 watts per ft. will give a temperature of 160° to 180°F. or as an alternative, heating cable of a length to give the same wattage is easy to install. For larger work the use of infra-red heating is worthy of consideration,

Scales.—Simple counter scales to weight up to 14lb. will be required.

Storage drums.—Two metal drums of about 6 gallons capacity with taps will be required to store resin, and the medium speed hardening agent. Other hardening agents are used much less frequently and can be stored in one gallon tins.

Mixing vessels.—The type of mixing vessel should be chosen to avoid the need to clean. The removal of epoxy resin involves the use of a considerable quantity of solvent which can be harmful to the skin, and, is not only a long job, but also an unpleasant one. It is recommended

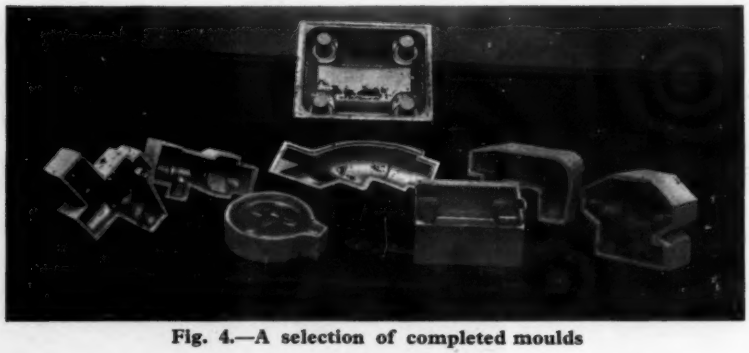

Fig. 4.—A selection of completed moulds

is almost universally adhesive it is necessary to seal the mould surface and to ensure complete seal, several coats of lacquer are required.

Release agents.—These are used to ensure easy release of the cast or laminated pattern from the plaster mould, and are in the form of silicone creamed waxes which can be applied by brush.

It is interesting to note that based on the purchase of one half hundred weight of epoxy resin, balanced stocks of these materials would cost approximately £60, and produce 1cwt. of patterns.

Equipment

Oven.—An oven with an electric heating element will be required for the drying of plaster moulds and the

that ¼, ½ and 1 gallon tins should be used and any excess of resin should be poured into a cardboard container—a screw box is admirable —the residue allowed to settle to the bottom of the tin and become solid. After use three or four times the tins can be replaced. The excess of resin poured into the screw box can be added to from subsequent mixings thus producing plastic in block form which can be used for print manufacture and pattern alterations etc.

The remaining items can be classed as miscellaneous, equipment and consist of: Paint brushes ½in. and 1in. width, rubber roller used in the process of impregnating fibreglass, palette knives, 3in., 4in., and 5in. blades with straight and crank shafts, scissors, thermometer, modelling clay, cellophane, rubber gloves, and barrier cream.

Ordinary barrier creams are unsuitable, but several firms manufacture resin resisting creams. Solvents —such as acetone and methylated spirits and a supply of clean rag and cotton waste are also necessary.

This material and equipment will cover the manufacture of any type pattern from the solid casting of small patterns to the making of large patterns by a system of lamination.

Storage

It is desirable that the storage, mixing, and casting of resins should be confined to an enclosed area. This can be in the form of an extension to the workshop, or an enclosure built within the shop. Resins, hardening agents, and lacquers are all of an adhesive nature, and it is an advantage to handle these materials in an area which can be kept clean and free from the usual dust of a Pattern Shop.

The temperature of a small enclosure can be controlled and maintained with ease, and the storage and use of resins in a constant room temperature is desirable. In a normal room temperature of about 65°F. the viscosity of resin is fairly low and the mixing of the various materials can be carried out with ease. In lower tempeatures, however, resins become difficult to mix and pour.

Fig. 2 is an illustration of the extension to the Crewe Locomotive Works Pattern Shop, built about two years ago, quite a small building, about 20ft. by 9ft. with a bench running the full length. You will note the resin and hardeners are stored on an elevated platform thus enabling the scales and mixing vessels to be placed in a convenient position for pouring and weighing.

The handling of resins is entirely confined to this building, and the other end of the bench is used for the manufacture of moulds, and the application of lacquer and release agents.

Patterns and Moulds

As plastic patterns are formed by pouring the plastic mix into open moulds usually made from plaster or by building the pattern shape in such moulds in the form of a laminated shell, split patterns of the type readily assembled to plates for machine moulding are particularly adaptable to manufacture in plastic.

In the first instance a master pattern will be required from which the plaster mould will be made. As epoxy resin does not contract from the mould surface during the process of hardening and curing the need for

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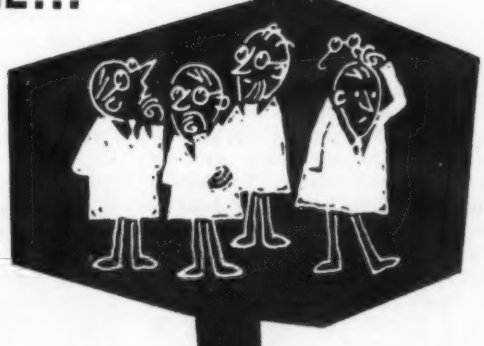

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a master pattern with double contraction, as required to produce a metal pattern is eliminated, and, if available, an existing floor or machine moulding pattern can be used. This should be repaired and checked to ensure that pattern taper will permit a good draw from the plaster. A good pattern surface can be secured by the use of a cellulose stopping, and this is important, as any imperfections will be faithfully reproduced on the plastic surface.

Should it be necessary to manufacture a pattern, this can be of simple construction as it will be fixed to a board during use. For example, the body, flange and prints of a pipe pattern can be made separately, and screwed together which is a more simple job than the normal jointing of a standard pattern.

Machining

The face of the pattern which will be in contact with the moulding machine plate should now be increased $\frac{1}{8}$in. for small patterns to $\frac{1}{4}$in. for larger patterns to provide material for machining. This machining operation is necessary to ensure dimensional accuracy, and to remove air bubbles from the plastic mix which will rise to the top face of the cast, furthermore, whilst the plastic material will not contract from the mould surface, there is a certain amount of sinking which will give an uneven top surface. This sinking amounts to about 4% and is well covered by machining allowance.

It is possible to avoid this machining operation and to secure a good face by closing the mould with a piece of plywood or metal, the face of which has been treated to secure release. The cast is fed through holes drilled through this cover at chosen points, and above these holes cardboard funnels are fixed which will carry additional resin to make good the sinking. I do feel, however, that it is better to increase this face to allow for machining.

The pattern should now be well coated with a good quality pattern enamel, and is ready for use. The pattern, or part pattern, as the case may be, is now screwed to a board of $\frac{1}{4}$in. thick plywood, and around the pattern is built a wooden frame leaving a minimum space of $\frac{1}{2}$in. between the pattern and frame. The depth of the frame should be at least $\frac{1}{2}$in. greater than the highest point of the pattern.

Fig. 3 illustrates a master pattern surrounded by a wooden frame. The machining allowance is clearly shown, and, as I have stated, is fixed to the pattern face which will be in contact with the moulding machine plate.

The surface of the pattern and the board to which it is secured should now be coated with thin grease, or a creamed wax polish to ensure easy release from the plaster.

The quantity of plaster required for a particular mould can be estimated by weighing the amount of water the frame will hold, and using 75% of this quantity, the addition of $1\frac{1}{2}$lb. plaster to each lb. of water will be found sufficient to fill the mould, and give a fairly thin pourable mix. This plaster mix is now poured into the frame vibrating a little to bring any air bubbles to the surface. When the plaster is firm, any surplus can be removed from the top of the frame, and the complete mould turned over to stand on this face. The pattern still secured to the plywood board can now be withdrawn. This must be done very carefully to avoid damage to the mould, and wooden wedges driven between the frame and base board will ensure an even draw. The frame can now be removed and the mould placed in the oven to dry.

Sealing

The final operation in preparing the mould is to seal the surface of plaster which will come in contact with the plastic material, and apply a release agent. Several coats of sealing lacquer will be required and can be applied by brush allowing 30 minutes for drying between each coat.

The importance of the thorough application of sealing lacquer is emphasized. Unless this sealing is complete, plaster will adhere to the plastic cast, and its removal will be a long and tedious job. A well sealed mould will possess a glossy surface and should any dull patches be evident a further coat of lacquer should be applied. One coat of creamed wax polish is now applied over this sealed surface to form a release agent, and the mould is ready for use.

This process is repeated for as many moulds as required, and is the same irrespective of the type of pattern to be made, or the technique to be used in manufacture.

It has been suggested that a single plaster mould can be used to produce a number of casts, and whilst I agree that this may be possible, is it really worthwhile? Plaster is a cheap commodity, and from a good master, moulds can be made quickly and the entire casts completed with one mixing. On the other hand if one mould only is to be used, and let us say six patterns are required, manufacture will spread over six days, and require six separate mixings. We now have our moulds ready to receive the plastic material in one form or another, but before passing from this part of the process, may I emphasize two points. Firstly, time spent in producing a good surface on the master pattern is well spent. It is much easier to produce a good surface on the wooden master than to rectify imperfections on the surface of the plastic pattern.

Secondly, and this is really important, unless the surface of the plaster is thoroughly sealed, the plastic material will penetrate the plaster, and not only will separation be very difficult, but the pattern surface will be rough and a considerable amount of work will be necessary to produce a good surface.

(To be continued)

Polymer Corporation

Stanley Wilk, vice-president, Finance, for Polymer Corporation Ltd., Sarnia, Canada, has announced the appointment of C. A. McKenzie to the position of manager, Special Projects, in the Economics and Development Group of the Company. Mr McKenzie will be handling business development projects as part of the company's intensified planning and development programme.

Bakelite polyester resins, reinforced with glass-fibre, have been used throughout for the bodywork, flooring and many components of a recently developed custom-built sports car of impressive performance now being manufactured by Layton Sports Cars Ltd., of Layton, Blackpool. Called the TVR 'Grantura,' the car is capable of speeds of 100 mph plus

ISR Anniversary

SUCCESSFUL FIRST YEAR'S OBSERVATIONS

IN October 1958 the International Synthetic Rubber Co. Ltd. went into 'full-stream' production of three main grades of Intol Styrene-Butadiene Synthetic Rubbers—Intol 1500, 1502 and 1710—at their newly built £6,000,000 plant at Hythe in Hampshire. At that time it was emphasized that the plant had been constructed to allow for expansion both in the grades and types of material produced, for it was appreciated that ISR could look forward to an increasing demand for synthetic rubber of high quality at home and overseas. Now, one year later, the wisdom of the early planners is evidenced by sales statistics and by forward market researches.

In response to requests from leading users two more oil-extended polymers—Intol 1712 and 1778 were added to the range during the year, together with latices R.23 and M.23. Up to this time all ISR's production had been the result of the 'cold' emulsion polymerization re-action process, but, in August 1959, ISR introduced their first 'hot' rubber, Intol 1006, this being required for specialized applications.

Noting the increasing use of synthetic latex as against natural latex in foam manufacture in the USA, and of the substantial interest being shown generally in high solids latex, ISR decided to plan production of a synthetic latex with a minimum solids content of 60% for use in foam rubber articles, carpet backing, adhesives, upholstery etc. It was, therefore, with some pride that on September 10 this year ISR announced that construction of a plant to produce 2½ million gallons annually of this material had commenced at Hythe.

In August, also, ISR announced that they had been appointed sole UK agents for the range of six standard and three non-staining grades of Socabutyl, products of Socabu, the new 20,000 ton butyl rubber plant situated at Notre Dame de Gravenchon. The Société du Caoutchouc Butyl (Socabu) had been formed by a consortium of 10 leading companies, among these being Esso, CFR, Michelin, Dunlop, Kleber Colombes, and ISR felt that the addition of these rubbers to the Intol range would be a further service to UK manufacturers.

Aerial view of the ISR plant at Hythe

Although the larger proportion of ISR's output is devoted to the home market, where it has made the UK independent of overseas sources of SBR an increasing tonnage is being exported to overseas markets. The general sales manager of the company, Mr H. J. Hornsby, has travelled over 60,000 miles this year investigating and reporting on markets in many countries, and the recent appointment of an export manager, Mr H. Wilson, is indicative of ISR's determination to exploit to the full the opportunities afforded by a rising world demand for synthetic rubber.

The company's synthetic rubbers are now being used in many branches of industry for a wide range of products, too wide, in fact, to list but including tyre manufacture, rubber bonded cork gaskets, industrial belting, sponge carpet underlay, rubber bonded asbestos jointing material, rubber suspension units for railway vehicles, shoe soles and heels, bicycle handle-bar grips, industrial hose, tyre retreads, latex foam trays, toy scooter tyres and chemical plant lining.

One of the notable features of ISR's expansion has been the considerable attention paid to technical service, for it was early appreciated that manufacturers would require the fullest details of how to use this new material in products which had in the past been made entirely from natural rubber.

During this first year, hundreds of visitors to Hythe have seen the plant in action and have been able to discuss problems of mutual interest with the 'men on the spot.' For those who were unable to come to Hythe, ISR prepared a short documentary film about the Intol plant, process and people and this has been shown in the UK, France and Southern Africa. In June 1959, ISR exhibited at The 5th International 'Salon de la Chimie' in Paris where, apart from meeting many foreign buyers, the ISR staff held a European Sales Conference with their agents.

The question has sometimes been asked 'How has all this been possible in so short a time?' The answer really lies in the fact that although ISR itself is only one year old, it has many thousands of man-years of background in the synthetic rubber industry. It began life with the tremendous advantage of access to the vast technical knowledge of some of the world's largest and most experienced synthetic rubber producers and has shared the benefit of their past achievements in research, development and production. This, when allied with the enthusiasm and ability of ISR's staff and the increasing demands of an expanding market, explains a successful year and augurs well for an even more successful future.

VIEWS and REVIEWS

NR From Individual Trees

A LEADING feature in *Rubber Age* for August (1959, 85, 5, 773 to 782) is a paper by my old friend 'Archie' Kemp, more precisely A. R. Kemp, now Research Associate of the University of California, on 'Constitution and Variability of Rubber from Individual Trees.'*

It is scarcely necessary here to recite at length the various qualifications of the author who from 1918 to 1948 was associated in connexion with rubber research and technology with Bell Telephone (originally Western Electric Co.) and has to his credit, as *RA* mentions, some 49 publications, and 'is the holder of 38 US and approximately 300 patents covering manufacturing methods and materials.'

Purpose of Paper: History

After briefly mentioning the various factors which may lead to variability of individual trees, the author remarks that 'very little study has been made of the rubber direct from individual trees' and that 'This situation is largely the result of the lack of suitable methods for such studies, and any result of such an investigation probably could not be related to variations in the bulked product.'

Kemp refers to Bloomfield's work in 1951 (Communication 271, 272 and 273, J. Rubber Res. Inst. of Malaya, vol. 13 (January 1951); Rubber Chem. Tech., Vol. 24, p. 737 (1951)) several times. As to a series of papers (*refs. as above*) giving results of a study of Malaya estate rubber from a few freshly tapped individual trees. The results of the present investigation will be closely compared with those obtained by the author. Bloomfield's investigation was directed mainly to investigations on solubility, viscosity and molecular weight distribution of the sol. hydrocarbon portion in the rubber from individual trees.

Kemp's references to Bloomfield's classical work are, as it appears to me, in no way contentious or controversial, but are, broadly, complementary, and explanatory. Thus (*e.g.*) he says, in relation to Table IV where a substantially direct comparison is in point:

'It is seen in Table IV that the range of sol. intrinsic viscosity for the alcohol coagulated rubber from latex taken from 24 different trees is 5.14 to 8.44, and these results are close to those found by Bloomfield for purified rubber . . . ,' and, further on: 'On the whole, the agreement between the two investigators is good. The large number of trees studied by the writer (*i.e.* Kemp) must also be considered in the comparisons made above, although even in the case of 24 trees, this is only a very small sampling to obtain an insight into the full spread of the variables involved in rubber produced by individual trees.'

Kemp's Sampling Method

In an earlier series of experiments—in Florida—where it appears that the climate is unsuitable for rubber culture, Kemp developed a method which was found satisfactory for sampling and preserving rubber taken directly from a tree 'which permits many variables to be studied. It consists in allowing a few ml. of the latex from a fresh tapping cut to flow into about 50ml. of 90% or absolute ethyl alcohol. This procedure results in immediate and complete coagulation of the rubber and kills all bacteria present in the latex. One can also note the colour and hardness of the coagulum, the nature of the serum and amount of non-rubber constituents separating from the serum on standing.'

Rubber from Costa Rica

As regards the present series the author points out that it was through the courtesy of the Goodyear Tire and Rubber Co. that he was permitted to visit its Speedway estate at La Francia on the eastern slope of Costa Rica. The trees on this 1,500 acre estate were planted from seedlings about 16 years ago. . . . All the trees were being regularly tapped (*full spiral every four days*).

The sampling of the 24 trees selected—trees bunched close together were chosen in order to study differences between individual trees rather than other factors—was carried out as described above—the whole 24 samples being taken in less than an hour.

A bulk sample was also collected from ten trees nearby and immediately coagulated by means of an excess of alcohol, and, in addition to this a sample of the bulked estate latex collected for the day was taken before dilution and addition of sulphite, and this sample was also coagulated with alcohol. Further samples comprised (a) one of acid coagulum from the same day's bulked estate latex and this was soaked in alcohol, and squeezed as free as possible from serum, and (b) a specimen of regular production crepe was obtained from the dryer, for comparison. This latter 'appeared to be high grade and normal in every respect.'

Tabular Information

Some rough idea of the comprehensive nature—within the programme defined—of the paper under review may be gathered from a mere recital of the descriptions relating to the nine tables included. The first two of these refer respectively to: I—Solubility and Viscosity of Rubber in Various Solvents (paper by Kemp and Peters in I/EC in 1941). II—Solubility and Sol. Viscosity in Chloroform of Florida Rubber (details *re Hevea*, Manihot, Glaziovii; Funtumia, and Hypostegia Hybrid). The remaining seven tables relate, substantially to the 24 samples of Costa Rica *Hevea*. III—Solubility and Sol. Viscosity of 24 samples. IV—Comparison of III specimens with bulked samples and with Crepe. V—Effect of Exhaustive Drying on solubility and viscosity on sample 17 in Various Solvents. VI—Fractionation of Composite (various properties) from samples 1 to 5. VII—Further Fractionation (various properties), from 7, 14, and 17. VIII—Fractionation of Costa Rica Crepe. IX—Fractionation of Gel

* *This paper was presented before the Rubber Division, ACS, at Los Angeles, May* 15 1959.

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by DR SCHIDROWITZ

(various data as regards solubility in two different solvents).

Some Conclusions

Rubber from individual trees showed wide variation, but the result from bulked latex and crepe are close to the average results found for the 24 trees.

Rubber direct from the tree contains soluble and insoluble fractions similar to those in crepe and smoked sheet. Lower polymers in the latter are also present in the latex as it emerges from the tree. It was found that some trees yielded a rubber completely soluble in benzene and chloroform, whilst in others the soluble form was as low as 61%, the average being 80%.

High viscosity of the sol. and high insoluble gel both yielded hard tough rubber. A new finding was that four out of the 24 trees yielded distinctly grey mottled coagulum—apparently from the presence of grey lutoids in the latex, but not visible in the latex as such.

The constitution of sol. and gel rubber is discussed and data are presented on the solubility and viscosity of the solutions obtained from the gel fraction. From these results it is concluded that the difficultly soluble gel has a three dimensional network structure with either oxygen or carbon to carbon linkages between the isoprene chains.

Rupture of Bonded Rubber Cylinders

Publication No. 302 of the British Rubber Producers' Research Association takes the form of a reprint of a paper by A. N. Gent and P. B. Lindley entitled 'Internal Rupture of Bonded Rubber Cylinders in Tension' (communicated by Sir Eric Rideal, F.R.S., to the Royal Society, which appeared in the *Proceedings of the Royal Society, A, volume* 249, *pp.* 195-205, 1958).

In their introduction the authors remark that an unusual process has been encountered in the course of an experimental examination of the tensile strength of vulcanized rubber cylinders bonded to plane metal end-pieces. This consists of the sudden appearance of internal flaws at a well-defined, and comparatively small tensile load. Their occurrence may be marked by a discontinuity in the curve relating the applied tensile load to the deflexion, and sometimes by an audible popping, while in particularly weak rubbers they may cause complete failure.

From a practical, technical point of view especially, as it seems to me, it is important to note that in general the flaws are wholly enclosed, and might well pass undetected, although their presence would be expected to impair strength, service behaviour and life.

History

Amongst the references it is mentioned that 'Yerzley (1939)' (*cf.* p. 205) has described a 'yield point' in the load extension relations of similar test pieces and attributed it to internal rupture. Where comparison can be made, his observations are in reasonable agreement with those 'described' in the reprint.

Cracking Point

The stress at which cracking occurred was, in general, clearly shown by a marked discontinuity in the load-deflexion relation (*cf. e.g., Fig.* 1, *p.* 196), accompanied frequently by an audible popping. This stress was found to be highly reproducible.

Table 1 comprises some figures relating, *inter alia*, to cracking stress and average breaking stress in certain mixings. This table is as under:

TABLE 1
REPRESENTATIVE VALUES OF BREAKING STRESS

Vulcanizate	Hardness (BS degrees)	Young's modulus (Kg./cm.²)	Cracking stress (Kg./cm.²) for test-pieces 0.3 cm. thick	Average breaking stress (Kg./cm²)*
A	70	60	28.7	106
B	63	42	25.2	113
C	55	28.5	15.9	103
D	45	18.0	12.3	66*
E	38	12.8	8.0	12.5
F	37	12.2	7.7	12
G	33	10.0	6.7	39.5*
H	32	9.5	6.95	34*

* Failure at the rubber/metal interface.

Acknowledgment to BRPRA and Proceedings Royal Society

Experimental

The test pieces consisted of VIR cylinders, bonded to plane metal end-pieces by means of (Ty-Ply) cements during the cure. Cylinders were generally 2cm. in diameter and from 0.06 to 0.5cm. in thickness. (Examples of formulations—in the Appendix—give details relating to eight mixings.)

Ultimate Strength

The authors' comment relating to the above is that 'the majority of test pieces failed ultimately at a value of applied stress many times larger than the cracking stress. Representative values are given in Table 1. For a number of particularly weak vulcanizates, however (for example, vulcanizates E and F in Table 1), total failure occurred consistently at a load only slightly higher than the cracking load. The fractures appeared to be due to the growth of one or two internal cracks to sever the test piece.'

(For further data and inferences the original should be consulted.)

PHILIP SCHIDROWITZ

Major Plastics Contract

AN important contract, calling for quantity production of plastics hulls for the new Alpha 12ft. sailing dinghy, has been placed with the Plastics Department of Bristol Aircraft Ltd. by Bossoms of Oxford. This is believed to be the largest single order ever placed in Britain for any type of plastics boat. This is the second major civil order recently received by Bristol's Plastics Department, following closely upon the signing of a contract with Lotus Cars Ltd. for large-scale manufacture of plastics bodies for the Lotus Elite sports car.

The Alpha is a thoroughbred racing dinghy and is claimed by Bossoms to be the first British craft of its kind to be designed from the outset for plastics construction. Stuart Wilson was responsible for its engineering design, and its hull lines were drawn by the famous designer, Ian Proctor. Bristol Aircraft Plastics Department built the prototypes of the Alpha and has developed a process for on site injection of the hull's plastics foam reinforcement. This foam, injected into the cavity between the inner and outer glass-fibre shells of the hull, gives the craft permanent buoyancy.

Questions Corner—86

(Second Series)

363. Discuss some of the properties of polyvinyl acetate emulsion films.

364. Give some account of the production and properties of the polycarbonates.

365. Give some data regarding the use of sisal in plastics.

366. Give some brief information on machining, particularly turning, of nylon products.

(Answers next week)

Answers to Questions Corner—85

359. Kinetic data is used for studying the chemical reactions involved in condensation polymerization and is concerned with the rate of disappearance of the monomer and the amount of polymer formed during the course of the reaction.

Physical and chemical methods are used and the following are discussed in 'Fundamental Principles of Polymerization' by D'Alelio, Pub. John Wiley and sons, 1952.

Physical Methods.

Distillation.	Dilatometic.
Refractive Index.	Absorption Spectra.
Viscosity.	Vibrational Spectra.
Density.	Conductance.
	Resistance.

Chemical Methods

End-group analysis.

Measurements of residual monomer.

Polyesterification reactions are usually studied under conditions in which the water formed is continuously removed.

360. A polymer mass is not homogeneous in the sense that it usually contains polymer chains of many different sizes. In some instances, the chains differ in length and composition. The molecular weight given to a polymer refers to an average molecular weight and each method of determination yields a particular type of average.

It has been shown that polymers consist of a mixture of molecules differing in molecular weight and it is usual to denote molecular weight averages by a bar over the values thus $\overline{M}$.

There are two ways of expressing the average molecular weight the first being 'number-average.' This is the average molecular weight obtained by methods which determine end-groups, and is thus called because it depends upon the number of molecules present. Analytical and osmotic methods are used.

The second way of expressing the average molecular weight is that of 'weight-average' and depends on methods which rely on the *weights* of the molecules present, *e.g.* by light scattering and sedimentation measurements. It depends on the total weight of polymer in a given volume of solution.

361. The ZST Test (Zero-Strength-Time) test was developed as a rapid and reliable method for determining the apparent molecular weight of chlorotrifluoroethylene polymers (Mod. Plast. 1954, *32*, 146 (Oct.)).

The test measures the time required to break a standard notched strip of polythene heated in a constant temperature oven and weighed with a standard load.

The temperature of operation of the ZST Test depends upon the first order transition temperature of the material being tested. The choice of temperature depends only on the molecular weight range of the material. Low molecular weight polymers are most conveniently measured at lower temperatures in order to obtain the maximum sensitivity.

Further details may be found in (Mod. Plast. 1936, *33* (7), 167) where the following values are given:

ZST Values for Bakelite Polythenes

	Viscosity Av. Mol. Weight	ZST Value sec.	Melt Index g./10 min./ 190°C.
DYNF ..	19,000	132	2.30
DYNH-1	20,000	138	1.94
DYNJ ..	22,000	150	0.92
DYNK..	25,000	163	0.30

362. There are, today, a profusion of plastics and a profusion of synthetic adhesives but some general rules can be suggested for use when choosing an adhesive.

Crystalline plastics are best bonded by heat rather than with an adhesive. If, of course, it is possible to use the melted polymer itself then this is probably the best.

Amorphous plastics may be bonded to themselves with the monomer or solvent cements.

To bond two different plastics, or a plastic to a non-plastic, a polymeric adhesive is recommended. The initial viscosity should be low but the final viscosity, before bonding, should be high. This can be achieved by the evaporation of the solvent, water or the polymerization of the monomer used.

Plasticizer migration may be a problem and the remedy may be to use a non-migratory polmeric plasticizer, which is incompatible with the other plastic, or to use a relatively unplasticized material.

(More questions next week)

New BPF Committee

EXPANDED POLYSTYRENE

THE Main Technical Committee of the British Plastics Federation, following a request by members, has recently set up a sub-committee to prepare specifications for expanded polystyrene products. The constitution of the committee has been drawn from materials' manufacturers, expanded polystyrene manufacturers and the fabricators of the expanded polystyrene.

Due to the increasing use and importance of expanded polystyrene, members considered that it was necessary to prepare specifications in order to protect the user from inferior products.

The Expanded Polystyrene Sub-Committee is considering, in the first instance, a specification for 'expanded polystyrene board for thermal insulation purposes.'

The committee has also been consulted with regard to the suitability of the product for various applications.

The committee has co-operated with the Society of British Aircraft Constructors on a note on 'Expanded Plastics' for inclusion in the SBAC Drawing Office Handbook, Volume 11., Plastics.

Reichhold Chemicals, Inc., has raised the price of flaked phthalic anhydride 2 cents per lb. to 19 cents per lb. Effective date of the new price is June 15 for spot sales and July 1 on contracts.

'A mill race is how the boys make up the bonus after a time-study rate fixing.'

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MEN and MATTERS

A Review of People and Events

by George A. Greenwood

HOW long does it take to get an industry, or a branch of one, going to the extent that it becomes nationally recognized? Apparently it all depends, as dear old Dr Joad used to say. But here is an interesting example of the fact that whereas in some cases it is a matter of a lifetime, in others it is all done within a decade, or at most, two.

Why do I say this? Because a company up in Lancashire, the Hardura Group Ltd., with an authorized and issued capital of £100,000, is in process of getting permission from the London Stock Exchange for public dealings in the shares. The company, which was incorporated only on September 11 last, and converted into a public one seven days later, and which has Mr Stanley Walsh, Mr Joshua Walsh, and Mr William Ernest Chapman as directors, started as a partnership between the Walshs as lately as 1943; Mr Chapman joined afterwards to become director of the four operating companies involved, in August last.

One or two of the four operating companies involved in this merger with a public issue—S. and J. Walsh (Plastics) Ltd., and its associate, Walsh Carpets, are already well known. These include coated felts, known as Hardura, and plastics products of a similar nature, and tufted carpets sold under the registered name of Hardura-loop.

Real Progress

The headquarters are at Great Harwood, in Lancashire, already so well known as one of the centres of the cotton trade, where a lot of material for processing with rubber and plastics is produced, but the Hardura Group constituents seem to be very much in a world of their own. Incidentally, the brothers Walsh, as I believe they are, must have started young, for Stanley Walsh is now 51, and Joshua Walsh only four years older. Mr Chapman is even younger at 45. There are now four factories at Great Harwood, the products of which go to some of the big motor car manufacturers for floor coverings, as trim and insulation in other parts of the car bodies. There are also large sales to shipping companies and aircraft manufacturers, and a good business is done with retail shops and stores for goods which are used as domestic floor coverings. The export market, too, is being well exploited.

Now this is real progress. The statement issued to accompany the application for public dealings shows that gross profits in the current year are at least a quarter higher than the entire capital of £100,000 which is being issued, and there are no charges of any kind against the assets, fixed and liquid, of the four associated undertakings.

Expansion

I am interested to hear that two well-known members of the secondary trades in the Midlands are entering the plastics waste trade, to add to their scrap metal activities. They are Messrs F. W. G. Church and Leslie Bramall, who are joined by Mr Peter Antrobus in forming Scrap Plastics (Walsall) Ltd. For the present it is a private company. This reminds me that Board of Trade returns are showing a considerable increase in the export of plastic scrap. I wonder why it is all going abroad?

As a postscript, I must tell you that I am wearing, as penance, a hair shirt —and it itches! The reason? Through a quite inexplicable error of the pen—or the typewriter—last week, I said that the annual dinner and dance of the Waste Rubber and Plastics Merchants' Association on October 24 is to take place at the Berkeley Hotel. It should, of course, have been the Park Lane Hotel. Sorry! It was a fine occasion last year.

US Rubber Moves

The United States Rubber Company has announced that Clarence H. Sigler, Jun., former technical sales representative in the Chicago area, has been appointed Vibrathane polyurethane commodity sales manager for the Naugatuck Chemical Division.

Upon graduation from Kansas University in 1942, Mr Sigler joined Naugatuck Chemical. He served in the production and research and development departments before being assigned to sales in 1946. Since 1948 he has been a member of the Chicago sales staff selling latex and latex compounds. In his new post Mr Sigler will supervise the sale and promotion of polyurethane resins for foam applications, and liquid and solid polyurethane elastomers for film, moulding and casting applications.

Ekco at Styling Exhibition

An interesting exhibit at the BREMA International Exhibition of Styling Accessories, held in London, October 6-8, was the representative selection of mouldings used by many leading radio and TV manufacturers shown on the stand of Ekco Plastics Ltd.

Two of the most interesting mouldings were the back cover and front for the new Ekcovision 17in. screen portable receiver, Model TP347—the 'slimmest-ever' television. These are attractively styled in polystyrene, their lightness contributing considerably towards the low weight of the complete receiver.

Moulded radio cabinets are also prominently displayed in various colours, while other exhibits included television receiver escutcheons, moulded controls, etc.

Participation in these occasions, is to me, typical of what I call the spirit of 'adventurous enterprise' always shown by the Ekco concern.

Purchasing Officers' Association

Congratulations are due to Aldridge Plastics Ltd. for achieving second place for their stand in the competition—Educational Class—at the annual conference and 'Minibition' of the Purchasing Officers' Association. This was held at Folkestone, September 24-26. As we reported earlier this year, the new president of the Association is Mr A. H. Thomas who is manager of purchasing, stores and raw materials control, British Belting and Asbestos Ltd.

Mr F. V. Thompson has been appointed director of personnel of British Insulated Callender's Cables Ltd. He relinquishes the position of secretary and manager (personnel), Mr J. P. Hourston has been appointed secretary, and is succeeded as assistant secretary by Mr G. V. Tew.

Rubber Stockpile Sales

US RELEASES TO START OCTOBER 16

THE General Services Administration (GSA) announced on October 2 that it would begin the sale of rotation rubber on October 16. No figure was given, but the plan is for sales of not more than 12,000 tons for each quarter of the fiscal year which ends on June 30 next.

The full text of the announcement was:

'In line with the announcement made by General Services Administration on September 15, the Agency today (October 2) announced that it will begin the sale on October 16 without replacement of the natural rubber required to be rotated during the fiscal year ended June 30 1960.

'This sale will be made in accordance with the provisions of the Independent Offices Appropriation Act for 1960 which provides for sale without replacement of excess perishable stockpile items which otherwise would suffer from deterioration.

'Sales will be for delivery from the stockpile in the current or succeeding three calendar months as in the past rotation programme. In all sales GSA will equalize freight with the purchaser with his normal port of entry in order to protect GSA's intransit privileges.

'Sales will be negotiated by telephone on the basis of prevailing market prices in such a manner as to avoid disruption of the usual rubber market and at the same time protect the United States against avoidable loss.

'Anyone wishing further information or to negotiate for the purchase of rotation rubber should contact Mr J. J. Wolfersberger or Mr J. P. McElligott on Executive 3-4900, Extension 4447,'

(The telephone number given in the announcement is the one for GSA headquarters in Washington.)

According to GSA, sales would be made with two criteria in mind: (1) They would be made at prevailing market prices, but in such a way as not to disrupt the rubber markets; and (2) they would be made at prices that would protect the US Government against what was described as unavoidable loss.

GSA spokesman said on October 2 that the agency did not know at that time how much rubber might be sold this month. The sale, however, would remain open until the goal of disposing of 12,000 tons had been reached. Whether that much would be sold in the first quarter of this fiscal year remained a question.

Dusseldorf Plastics Symposium

Owing to the numbers attending the International Symposium on the Ageing of Plastics (October 19) and the 8th German Plastics Convention (October 20-21), these events will not be held, as previously announced, at the Robert Schumann Room at the Dusseldorf Plastics Exhibition but in the Rheinhalle, formerly the Planetarium, just outside the Exhibition grounds. To date, 1,432 are participating of whom more than 360 are from 16 European and eight overseas countries.

RJIP at Dusseldorf

RUBBER JOURNAL AND INTERNATIONAL PLASTICS is exhibiting on the British combined stand organized by the Board of Trade and the British Plastics Federation. Readers in Dusseldorf will be most welcome on the stand, No. 3203-3207, first floor, Hall C.

Plastics in Building

TWO DAY CONFERENCE

The Plastics Institute has arranged a conference on 'The Influence of Plastics in Building' to be held at the headquarters of the Royal Institute of British Architects, 66 Portland Place, London, W.1, on Thursday and Friday November 19 and 20 1959.

Papers will be given by C. W. Welch, editor of *Plastics*, S. Greenwood, A.R.I.B.A., chief architect of John Laing and Sons Ltd; D. S. Mahon, B.Sc., sales development manager, Bakelite Ltd.; W. L. Thorne, technical officer, I.C.I. Ltd.; W. B. Brown, B.Sc., Ph.D., A.R.C.S., D.I.C., senior development chemist, Monsanto Chemicals Ltd.; and G. K. Findlay, L.R.I.B.A., consultant architect to Unity Structures Ltd. Chairmen at the three sessions of the conference will be H. F. Wilson, B.Sc., A.R.I.C., A.I.R.I., Companion I.E.E., president of the Plastics Institute; L. M. Read, A.R.C.S., A.M.I.Chem.E.; and G. Tolley, M.Sc., Ph.D., F.R.I.C.

Admittance to the conference will be by ticket only. Registration forms can be obtained from the Plastics Institute, 6 Mandeville Place, London, W.1 (telephone: WELbeck 5439).

Mr A. H. Thomas, of British Belting and Asbestos, has been elected president of the Purchasing Officers' Association for 1959-60.

International Standards

STRONG UK CONTINGENT FOR NEW YORK

THE eighth meeting of Committee ISO / TC / 45 (International Standardization of Rubber) will be held in the Henry Hudson Hotel, New York, from October 26–31. Since the first meeting in London in 1948 considerable progress has been made by this committee in the drawing up of standard methods of testing rubber; one measure of this progress is the increasing number of methods in national specifications, for example BS 903, which are based on these internationally agreed methods. A large number are under review and at the New York meeting it should be possible to agree on the details of several new methods which have been studied by working groups over the past few years.

Work of this kind is of great importance to the rubber industry in all countries and therefore it is essential that each country sends acknowledged experts to represent their point of view. Delegates from the following countries will be present at the New York meeting: Czechoslovakia, France, Germany, Holland, Hungary, Italy, India, New Zealand, Pakistan, Russia, Sweden, Turkey, UK and the USA. The UK are Secretariat for Committee ISO/TC/45. A strong UK delegation of nine experts under the leadership of Dr J. R. Scott of RABRM, will attend the meeting at which Mr J. M. Buist of Dyestuffs Division, Imperial Chemical Industries Ltd., will be chairman. Mr Buist was elected chairman in 1958.

The success of these meetings depends very much on the calibre and tact of the delegates and the UK is fortunate in having such a strong team. We wish Mr Buist and his colleagues every success.

Mechanical Shearing of Polymers

INVESTIGATIONS IN USA

THE US National Bureau of Standards in conjunction with the US Government Synthetic Rubber Programme, has recently investigated the effects of mechanical shearing on polymers in concentrated solutions in order to obtain basic information on the strength of intermolecular entanglement in polymers and their flow stability.

When high-polymer molecules are subjected to severe mechanical shearing, they are sometimes broken down into smaller molecules. This degradation may be produced either by the heat dissipated in the shearing process or directly by the mechanical forces involved in the shearing. Isolating the degradation due to the mechanical forces themselves, A. B. Bestul and co-workers in the Bureau's rheology laboratory have established several defining features of degradation associated with mechanical shearing. Their research indicates that under a given set of shearing conditions, a polymer will degrade to a molecular weight level representative of these shearing conditions and below which no further degradation will occur. The occurrence, rate, and ultimate extent of rupture depend on the occurrence and severity of the shearing under otherwise identical conditions. The degradation does not result either from incomplete solution prior to shearing nor from cavitation in the shear field but is caused by the shearing itself.

Mechanical Degradation

Work on degradation is useful both in theoretical and applied areas of polymer science. In the theoretical field, research on mechanical shearing is leading toward better understanding of high-polymer structures, especially of entanglements and other interconnexions between such molecules. In the applied field, for such technological processes as lubrication, pumping, ultrasonic applications, milling, shaking, turbulent flow, and lamellar flow, polymeric substances are deliberately or incidentally subjected to shearing—which may be severe enough to cause rupture within the molecule. By studying mechanical degradation, the use of polymers that degrade excessively under severe conditions can be avoided and special polymers that will remain intact under such conditions can be developed.

Unfractionated polyisobutene in n-hexadecane solution was the polymer system most thoroughly investigated. Solutions containing 3 to 20 mole % of the polymer were sheared by being repeatedly forced through the capillary of the McKee Consistometer, an instrument developed to test experimental fluids of high viscosity. This device has a capillary hole penetrating a disk which is clamped between two steel cylindrical tubes, each equipped with a closely fitted piston. The pistons repeatedly force the polymeric solutions to pass back and forth through the disk. As the instrument is essentially symmetrical with respect to the cylinders and has pistons on both sides of the disk, successive measurements can be made by moving the pistons in alternate directions.

Recording and Testing

Records were made of the load on the Consistometer for every other pass of a sample. Data were obtained for nominal rates of shear from 9,000 to 100,000 sec^{-1}, temperatures from 20° to 80°C., and initial viscosity-average molecular weights from 600,000 to 2,520,000. Some of the runs were interrupted at various stages of the degradation process. Viscosity-average molecular weights were then determined for the polymers present at that particular stage of shearing, and the extent of degradation determined from these.

To examine specific details of the process, incidental measurements were made on solutions of polymer fractions obtained from degraded and undegraded starting materials and of polymers precipitated completely from degraded stock. In some of these tests, shearing was interrupted for different periods but subsequently completed.

It was found that the rate of degradation is proportional to the concentration of the bonds present at fixed shearing conditions. Within certain conditions — polymer concentrations between 5 and 20 weight % and temperatures between 30° and 50°C.— the proportionality factor between degradation rate and bond concentration (rate constant) is independent of temperature and bears the same relation to the rate of shear energy application that exists between the rate constant and temperature in thermally activated chemical reactions. This similarity suggests that mechanical shear degradation can be considered as a mechanically activated reaction, and leads to a distinguishing feature between the molecular processes occurring in mechanical and in chemical degradations. This characteristic is the source of energy which raises the energy state of molecular bonds to a level high enough to cause rearrangement of the atoms. In shear degradation, this energy appears to be supplied from mechanical energy associated with the shear field rather than from thermal or electromagnetic sources, for example.

Generation of Energy

If the energy generated in the shear field is uniformly distributed, the energy developed in the volume occupied by an individual bond (and the two atoms it connects) can provide only a small part of the necessary energy. Therefore, to provide the energy needed to rupture a single bond, energy developed in a larger volume than the immediate bond vicinity is required. The energy from this large volume of the shear field must be in some way concentrated into the bond. It has been suggested that this concentration may be accomplished by the accumulation of stresses due to the shearing through entangled molecular chains, *i.e.*, overlapped or entwined polymers.

Further Characteristic

Another characteristic of mechanical shear degradation is the large amount of energy used by the process per bond ruptured—the values were found by the Bureau to be in the neighbourhood of 300,000 kilocalories per mole of bonds ruptured. Since this large amount of energy is several thousand times any reasonable value for the bond energy of carbon-carbon bonds, it is evident that some of the energy is not utilized in the rupture itself but is somehow lost in the process. This may occur during bond rupture when part of the energy stored in neighbouring bonds or macromolecular segments may be immediately dissipated as heat, rather than first being utilized in the shearing process. This energy would be measured and included in the overall

energy loss for the degradation process.

Although general information on the number of neighbouring bonds or macromolecules which are instrumental in transmitting activation energy to a ruptured bond can be estimated, detailed data cannot be obtained, as it is not as yet possible to measure several quantities necessary for detailed calculation. These undetermined values include the actual amount of energy accumulated in individual neighbouring bonds, the proportion dissipated as heat immediately upon rupture, and the respective proportions stored as potential energy in the bonds and as reduced configurational entropy of the macromolecular chains formed by the bonds. However, results of fractionated polymers precipitated from unsheared and previously sheared samples support the conclusion that the transmission of activation energy into a single ruptured bond involves several polymeric chain macromolecules. In the degradation, the individual macromolecules with the highest molecular weights are ruptured. But degradation occurs only if at least a minimum concentration of these large molecules is present.

Under extreme conditions (relatively low concentration or high temperature) both the rate and energy requirements of mechanical shear degradation deviate considerably from the above results. That is, the rate varies much more rapidly with the temperature, and the energy requirements are higher. Presumably the polymer cannot form sufficient effective entanglements at low concentrations and the viscosities of the solutions are too low to develop adequate shearing forces at high temperatures.

Recent work with Consistometer capillaries of different lengths and diameters has indicated that shear degradation occurs in the entrance end of the capillary for a distance many times the capillary diameter. Interesting effects of the exact geometry of the capillaries have been demonstrated with capillaries having exaggerated deviations from right-circular, cylindrical geometry. These variations took the form of a chamfered and a tapered bore at one end of the capillary. The taper has a marked effect on the degradation results, as shown by the substantial degradation patterns observed in flow through this type of capillary in the two opposite directions. However, the chamfer at the edge of the capillary has little effect on this degradation, presumably because it does not extend over an appreciable part of the capillary distance where degradation occurs.

Poppe Rubber Deaths

Mr Sydney F. Poppe, chairman of the Poppe Rubber and Tyre Co. Ltd., Sherland Works, Twickenham, Mddx., died on September 11 at the age of 51. Mr R. F. Holden, 69, managing director of the company, died on September 18.

Mr Holden, who was chairman of of the Food Jar Rings Association and a past member of the council of the Federation of British Rubber Allied Manufacturers, was on holiday in Switzerland at the time of Mr Poppe's death and he flew back to this country for the cremation. After the service he left to resume his holiday and collapsed and died at London Airport. He had been with the company since 1932.

Mr S. F. Poppe, who joined the company in 1926, succeeded his father, F. Poppe, to the chairmanship in 1947.

Mr Edmund Stekel and Mr Seymour Kraft have joined the Board of the Tremelbye (Selango) Rubber Co. Mr G. H. Masefield and Mr P. R. Rutherford have resigned as directors.

IRI Anniversary

LEICESTER SECTION'S 25th YEAR

SIR JOHN DEAN, president of the Institution of the Rubber Industry, and Lady Dean have accepted the Leicester Section's invitation to their Silver Jubilee dinner-dance which is being held on Tuesday November 10 at the Grand Hotel, Leicester.

Tickets for this function are now available, price 30s. each from the hon. secretary, Mr J. Devlin, B.B. Chemical Co. Ltd., Ulverscroft Road, Leicester.

Baekeland Memorial Lecture

On Thursday October 22 Prof H. Mark, Director of the Polymer Research Institute, Polytechnic Institute of Brooklyn, New York, will deliver the fourth Baekeland Memorial Lecture under the title 'Recent Progress in Polymer Chemistry.'

The lecture will take place in the lecture theatre of the Royal Institution of Great Britain, Albermarle Street, London, W.1, at 6.30 p.m. Admission is free.

Mr Robert E. Fearnley-Whittingstall has been appointed to the board of The Rubber Estates of Malaya.

US Plastics Sales

1960 PROSPECTS GOOD

SALES of plastics in the US in 1960 will continue to increase but probably at a slightly slower pace than the recent experience, according to US Rubber Company's president, Mr George Vila. Mr. Vila told the annual sales forecasting conference of the American Management Association that the plastics industry is currently 'rolling along' at an annual rate of 5,400,000,000lb., or 17.4% over last year.

Mr Vila attributed the 'boom' in plastics to increased use in automobile manufacture, revival of the consumer durable goods industry and the anticipated spurt in building construction in 1960.

Polythene, both conventional and high-density, was the leading material. It was now being sold at the annual rate of 1,150,000,000lb. or about 30% more than in 1958.

In the field of consumer durable goods such as appliances and automobiles, high employment and rising personal income favour gains in sales, according to Mr Fred Hoyt, vice-president of Carrier Corp., maker of air conditioning equipment. Mr Hoyt was another of a group of panelists appraising the outlook for various lines of business and industry. He told the conference, 'the big "if" is how much credit will be available.'

Looking ahead at capital goods equipment prospects, Mr Alexander Bupp, assistant to the president of Bucyrus—Erie Co., said concerns 'should reach a peak during the first half of 1960, orders should peak out during the second half, backlogs should continue to build throughout 1960 and shipments should continue to increase throughout the year.'

Mr Bupp estimated that total spending for capital goods equipment, exclusive of plant buildings and other non-equipment items, could approach an annual rate of $30,000 million in 1960. (It reached an annual rate of $26,000 million in the second quarter of 1959.) He cautioned, however, that 'it is necessary to fully appreciate the delays and distortions of the steel strike.'

Rubber Statistics

WORLD POSITION AT THE END OF JULY

THE latest Press release issued by the Secretariat of the International Rubber Study Group shows the world rubber position up to the end of July last.

NATURAL RUBBER
(1,000 tons)

	July 1959	Jan.-July 1959	Jan.-July 1958
Production	172.5	1,155.0	1,075.0
Consumption	175.0	1,232.5	1,110.0

Production of natural rubber, though considerably in excess of the amount produced during the same period of last year, is still not keeping pace with consumption; in fact, the gap, which to the end of June amounted to 70,000 tons, has now widened to 77,500 tons. Stocks now represent rather less than four months' supply.

The July consumption total of 175,000 tons includes estimated imports into Russia of 17,000 tons and into China of 10,750 tons. Up to the end of July, imports into Russia had totalled 134,500 tons, and those into China 72,000 tons, making 206,500 tons in all or some 17% of all the natural rubber consumed during these months.

Synthetic Rubber

The synthetic rubber position was as follows:

SYNTHETIC RUBBER
(1,000 tons)

	July 1959	Jan.-July 1959	Jan.-July 1958
Production	125.0	825.0	655.0
Consumption	127.5	860.0	687.5

Both production and consumption of synthetic rubber continue well above last year's levels, with consumption still outstripping production slightly. On the other hand, the Study Group points out that the July production figure does not take into account synthetic rubber produced in either the United Kingdom or in Italy.

US General Position

The US Department of Commerce has issued the following preliminary statistics for the month of June: *Natural Rubber*—Consumption, 47,545 tons, of which latex 5,004 tons. Stocks, 80,059 tons (latex 10,752). *Synthetic Rubber*—Production, consumption and stocks in that order: S-Type, 94,749; 78,995; 142,606. Butyl, 6,391; 6,043; 9,899; Neoprene, 9,365; 6,277; 15,187. N.-Type, 3,811; 2,419; 8,912. Totals, 114,316; 93,734 and 176,604.

Total new rubber consumption during July amounted to 141,279 tons (June 139,481). Natural rubber accounted for 33.65% of new rubber (June 34.26%). Total consumption to the end of July amounted to 936,741 tons (735,187 tons during the first seven months of 1958)—an increase of some 27%.

Brazil

The Comissao Executiva de Defesa da Borracha has now issued figures for the Brazilian rubber position up to the end of the first six months of 1959. Local production amounted to 13,361 tons in all (1958 13,014 tons). Imports of natural totalled 13,186 tons, with consumption (21,391 crude, 615 latex) at 22,006 tons. Comparable 1958 figure was 21,567 tons.

Imports of synthetic rubber during the half-year amounted to 3,768 tons (3,248 tons of SBR) and consumption totalled 3,477 tons (2,500 tons of SBR).

Western Germany

Tyre production in Western Germany during July was 16,609 tons, against the June 1959 figure of 17,731 tons, and the July 1958 total of 14,068 tons. Production to the end of July 1959 totalled 111,176 tons (1958 figure, 88,355 tons).

Production of other hard and soft rubber goods during July was also somewhat lower than in the previous month, with 19,669 tons against 20,460 tons. Total production to the end of July amounted to 130,612 tons compared with 125,052 tons a year earlier.

Imports of natural rubber and sole crepe amounted to 62,490 tons during the first half of the year. Imports of synthetic during the half-year totalled 17,111 tons, including 12,793 tons from the USA, 2,607 tons from Canada and 1,466 tons from Italy.

Company in the News

Hecht, Levis and Kahn Ltd.

The consolidated total profit of the Hecht, Levis and Kahn group for the year ended March 31 1959 was £422,370, an apparently disappointing result when compared with £696,297 for the previous year. However, the profit, after tax, attributable to members of the company was £161,246, a drop of only £39,985, while the net assets of the group rose by £152,104 as compared with a rise of only half that amount in the previous year, after appropriations of approximately the same amount. Approval has been given to a bonus issue of one new share for each stock unit at present held, thus doubling the ordinary capital. A bonus of 25% has been recommended and the company expects that it will be possible at least to maintain the same effective distribution in the future.

Rubber Crop Returns

Unless otherwise indicated the figures quoted, to the nearest thousand lb., represent crop returns for the month stated and for the number of months of the planting company's financial year to date. Corresponding figures are given in parentheses.

RUBBER ESTATE AGENCY

August

Bandar Sumatra.—95 (86). 1 mth—95 (86).
Batu Kawan.—68 (60). 12 mths—746 (704).
Buntar.—125 (90). 2 mths—247 (183).
Eastern Sumatra.—361 (370). 6 mths—1,826 (1,786).
Amalgamated Rubber.—29 (22). 8 mths—268 (277).
Java Rubber Plants.—33 (33). 8 mths—652 (672).
Jeram.—*364 (229). 5 mths—1,612 (998).
Kepitigalla.—80 (55). 5 mths—264 (281).
Kuala Lumpur.—†700 (394). 2 mths—1,362 (790).
Langkat Sumatra.—73 (77). 8 mths—579 (571).
Soember Ajoe.—17 (20). 11 mths.—283 (318).
Sungei Bahru.—134 (100). 2 mths—251 (202).
Sungei Kahang.—159 (150). 6 mths—923 (852).
Tambira.—112 (118). 2 mths—216 (238).
Tamiang (Malaya).—74 (68). 11 mths—805 (666).
Tanjong Malim.—405 (342). 2 mths—778 (649).
Sennah.—152 (152). 8 mths—1,146 (1,095).

* Including crop from Tuan Mee Estate.

† Including crop from Sungei Kawang Estate.

HARRISONS AND CROSFIELD

South India and Ceylon—August

Malayalam.—632 (252). 5 mths—2,622 (2,438).
Lunuva.—131 (134). 8 mths—816 (914).

Beau Sejour.—57 (70). July—60 (69).
Ceylon (Para.).—135 (128). 895 (932).

THOMAS BARLOW AND BRO.

August

Bradwall (FMS).—155. 8 mths—1,014 (1,096).
Chersonese (FMS).—77. 8 mths—476 (440).
Highlands and Lowlands Para (including Scottish Malayan).—2,142. 8 mths—14,898 (13,535).
Klabang.—104. 8 mths—710 (656).
Krian.—12. 8 mths—72 (112).
Muar River.—115. 8 mths—836 (970).
Sungei Krian.—173. 8 mths—1,216 (1,252).
Manchester North Borneo.—75. 5 mths—377 (327).

Malaya General. August.—172 (221). 11 mths—2,471 (2,141).
Mengkibol. August.—90 (75). 7 mths—672 (597).
Sedenak. August.—155 (181). 9 mths—1,853 (1,751).

Mr H. T. Kemsley, secretary of British Industrial Plastics, has been appointed a director of the company. He will continue to act as secretary.

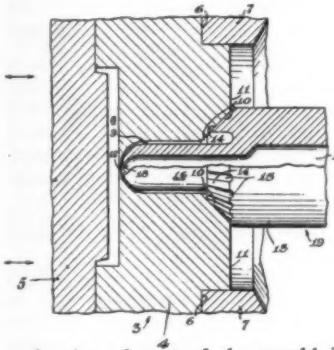
PATENT SPECIFICATIONS

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

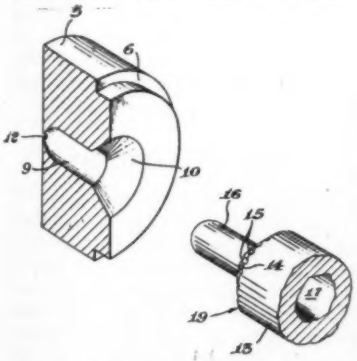
Moulding Apparatus

No. 810,631. The Dow Chemical Co. Application and Filed, December 3 1956. Application in USA, December 27 1955. Published, March 18 1959.

A mould and an injection nozzle of an injection moulding machine are designed to produce plastic mouldings substantially without sprues. Fig. 1 is



an elevation of part of the mould in section and of part of a co-operating injection nozzle, partly in section. Fig. 2 is a perspective view of part of the mould and of part of the disengaged nozzle. As shown, the circular mould 3 comprises a cope or front wall 4 and



a drag or rear wall 5, the wall 5 being movable relative to the stationary wall 4, as indicated by the directional arrows, in order to open the mould for release of moulded articles and to close the mould to form the mould cavity 8. The mould 3 is mounted on a platen ring 7 which is peripherally fastened around an indented edge rim 6 formed in the front wall 4 of the mould. A gate 12 is centrally provided in the front wall 4 to pass molten, thermoplastic material from the injection nozzle 19 into the mould cavity 8. The segment of the front wall surrounding the gate is thin and pressure-flexible. The recess 9 opens out on the outer surface 11 of the front wall 4 to provide access to the gate 12 for the spout 16 which projects from the injection nozzle 19. The recess 9 is bevel-edged at its outer end on the surface 11 to constitute a bearing surface 10 on the mould for engaging and restraining the nozzle 19 by means of the shoulder 14 to absorb the bulk of the generated thrust when the nozzle is forced into sealing contact against the mould during injection.

A progressively more impervious and effective sealing contact is obtained between the terminal end of the recess 9 of the mould and the seated, rounded tip of the spout 16 during injection of material into the mould. This is due to the convexity assumed by the pressure-flexible segment of the front wall 4 surrounding the gate 12 as it is distended by the increasing pressure in the filling mould cavity 8 and forced into continuously tighter engagement with the spout. The direct conducted heat loss from the nozzle to the mould is minimized due to the minimized contact area required for seating the nozzle tip in sealing contact on the mould. The thrust-absorbing bearing surfaces 10, 14 in the mould and nozzle permit a thin front wall section to be employed in the vicinity of the gate 12, and as a consequence, a gate may be employed which has a depth of 0.03125in. or even less. This facilitates the manufacture of injection mouldings having drastically reduced and often nearly flat and imperceptible sprues.

Shorter Abstracts

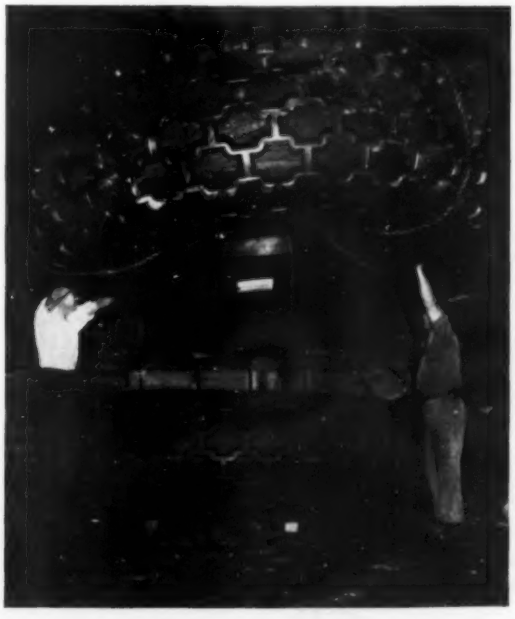
Polymerization of Ethylene. 811,909. Société des Usines Chimiques Rhone-Poulenc. Filed, April 3 1957.—A catalyst for the polymerization of ethylene is made by heating aluminium with aluminium chloride at a temperature up to 300°C. Polymerization of ethylene with the catalyst may be effected at pressures only slightly higher than atmospheric, but it is preferred to operate at pressures of 10-50 atmospheres.

Butyl Rubber Co-vulcanizates. 811,536. Esso Research and Engineering Co. Filed, December 27 1956.—Butyl rubber is co-vulcanized with natural rubber or a highly unsaturated synthetic rubber in any proportions by means of sulphur and a minor proportion of bismuth oxide or cuprous oxide, or a mixture of these two oxides. The co-vulcanizates are particularly suitable for use in making tubeless and other tyres.

Polymerization of Ethylene. 811,633. Farbenfabriken Bayer AG. Filed, May 26 1955.—Ethylene is polymerized in an inert anhydrous solvent in the presence of one or more of the following catalysts: activated titanium or zirconium and titanium or zirconium compounds in which the metals have a valency less than three, the compounds being free from metal-organic compounds.

Adhesive Tape. 812,422. P. Beiersdorf and Co. AG. Filed, January 25 1956.—A mixture of a polyvinyl ether and an acrylonitrile copolymer is used as a primer for pressure-sensitive adhesive tape or sheet.

Polymers. 812,983. Imperial Chemical Industries Ltd. Filed, April 23 1957.—Dimethyl vinylphosphonate and its polymers and copolymers are claimed.



LARGEST YET

Six of the biggest tyres in the world arrived in London last month. They are Firestone 36.00-41 48-ply rating earthmover tyres. Each weighs 1½ tons, stands 9ft. 7in. high and has a cross-section of 39in. Each tyre can carry a load of over 33 tons at 55lb. inflation pressure

Rubber Markets

LONDON

Very quiet conditions prevailed in the London rubber market but a sharp fall in prices followed the news that the United States is to start stockpile sales of rubber on October 16. Prices steadied after the initial fall which followed this announcement and the forward positions recorded little further change but the Spot lost further ground. On the week, therefore, Spot is 1¾d. lower at 32¼d. but losses in the forward positions are limited to around ⅝d.

Latest prices are as follows:
No. 1 RSS Spot: 32d.-32¼d.

Settlement House:
November 29¾d.-30d.
December 28¾d.-29d.
January/March 28¾d.-28¾d.
April/June 27½d.-27⅝d.
July/September 27½d.-27⅝d.
October/December 27d.-27½d.

No. 1 RSS cif basis ports:
November 28¾d.-28¾d.
December 28d.-28¼d.

Godown:
October 98⅝ Straits cents nominal.

LATEX

Centrifuged latex per gallon in drums, December shipments, 18s. 3d. seller, cif European ports. Spot, £1 nominal. Bulk, 17s. 10d. nominal. December delivery, nominal. Creamed, seller, 17s. 9d. November. Normal, seller, 14s. 2d. September/October.

AMSTERDAM

The Amsterdam rubber market ruled as follows on October 5:

No. 1 RMA	Guilders per kilo Oct. 5	Previous
October	3.11	3.11
November	3.07	3.07
December	2.98	2.98
October/December ..	3.03	3.03
January	2.82	2.82
February	2.82	2.82

Sales: Nil Tendency: Easy

CEYLON

No. 1 RSS

The price for No. 1 RSS Spot, at Colombo on October 5 was 118¾ (121¾) Ceylon cents per lb.

SINGAPORE

The news that the US General Services Administration was beginning the sale of stockpile rubber on October 16 brought out heavy selling at the outset on October 5, but fairly strong short-covering absorbed the liquidation at the lower levels. The market subsequently ruled quiet and cautious at around the one dollar level for October. Lower sheet interest was small and the main interest was centred in nearby. The market ruled quiet with narrow fluctuations during most of the afternoon. More buying interest towards the close caused a slight improvement and sellers became more reserved. Lower sheet was in some demand but little business was concluded. The market finished on a slightly steadier note.

	Straits cents per lb., fob Malayan ports to open ports Close	Previous Close
No. 1 RSS, Oct.	99⅞–100¼	102¼–102½
Nov.	97¼– 97½	99¼– 99⅜
No. 2 RSS, Oct.	99½–100	101½–102
No. 3 RSS, Oct.	98½– 99½	100⅜–101¼
No. 4 RSS, Oct.	97½– 98½	99⅜–100⅜
No. 5 RSS, Oct.	96½– 96⅞	98½– 99¼
No. 1 RSS, Spot	100⅛–101⅛	102⅛–103⅛
No. 3 blanket, thick remilled Oct.	97 – 99	99 –101
No. 1 fine pale crepe, Oct. ..	111 –113	113½–115½
Thin brown crepe, Oct. ..	96⅞– 97⅞	99 –100

Tendency: Slightly steadier

The Industries Syndicate quote latex, native produce, 60% centrifugal, packed in rec. drums fob at 198.80d. per gallon.

BANGKOK

No. 1 RSS

The price for No. 1 RSS, at Bangkok on October 5, was 32.25 (32.50) US cents per lb.

NEW YORK

The New York rubber market ruled as follows on October 5:

DEALERS' PRICES

	US cents per lb. Oct. 5	Previous
No. 1 RSS, Oct. ..	38n	38½n
Nov...	36½n	37n
No. 2 RSS, Oct. ..	37⅜n	38⅛n
Nov...	36n	36⅜n
No. 3 RSS, Oct. ..	37⅛n	38n
Nov...	35⅜n	36⅛n
No. 1 RSS, Spot..	Unquoted	45n
No. 3 amber blanket crepe, Dec...	34b–34½a	35a
No. 1 latex, thin crepe, Oct. ..	39n	39½n
No. 1 latex, thick crepe, Oct. ..	40n	40½n

FUTURES—REX CONTRACT

	US cents per lb. Close	Prev. Close
November	36.25–36.23t	37.25–37.15t
January..	33.80t	34.35b–34.45a
March ..	33.10t	33.60b–33.80a
May ..	32.70b–32.80a	33.10b–33.30a
July ..	32.50b–32.70a	32.85b–33.10a
September	32.30b–32.50a	32.60b–32.80a
November	32.10b–32.30a	32.40b–32.60a

Sales: 56 Tendency: Easy

Rubber futures were easy on October 5, declining by more than half a cent per lb. on scattered selling. Lower foreign markets and the recent US stockpile sale announcement induced the selling. In the afternoon rubber futures were very quiet and the undertone easy. Nearby November declined by about a cent for the day, the other months were about half a cent lower. Dealings were meagre in the afternoon. Traders said that physicals were very quiet and factories were showing negligible interest in rubber.

DJAKARTA

The Djakarta rubber market ruled as follows on October 5:

	Rupiahs per kilo Oct. 5	Previous
Spot No. 1 Priok..	30.80b	30.80b
Spot No. 2 Priok..	29.65b	29.65b
Spot No. 3 Priok..	28.60b	28.65b
No. 1 fine pale crepe, spot ..	29.00b	29.00 quoted

Tendency: Quiet

SR Plant for India

PRODUCTION IN 1961

THE Firestone Tire and Rubber Company announce it will participate in a $30m. project to establish complete facilities for manufacturing synthetic rubber in India. Firestone, with the participation of private banks in the US and the UK, will provide half of the initial capital, Mr Harvey S. Firestone, Jun., the company's chairman, said in Akron. The remaining capital will be raised in India where a public company will be formed, he said. The project has been approved by the Indian Government.

Firestone Tire will operate the project in association with Kilachand Devchand Company Private Ltd. of Bombay, Mr Firestone said. This will represent India's first synthetic rubber project.

Production is expected to begin in about 21 months and will be at the rate of 20,000 tons of synthetic rubber a year, but the plants will be designed to produce 30,000 tons eventually.

New SCI Group

A new subject group of the Society of Chemical Industry has been formed and will be inaugurated at a meeting to be held in the rooms of the Society at 14 Belgrave Square, S.W.1, on Thursday November 12. The new group will be named the Heavy Organic Chemicals Group, and the first officers are: Chairman, Dr R. Holroyd; deputy chairman, Dr M. A. Matthews; hon. secretary, Mr H. P. Hodge. The Inaugural Lecture will be given by Mr D. G. Smith under the title 'The Production of Bulk Organic Chemicals,' at 6 p.m. on November 12.

Next year's Dunlop Golf Tournament will be played over the Gleneagles Hotel courses on May 5, 6 and 7.

Industry INTELLIGENCE

Publications Received

'Polyurethanes For Surface Coatings'

This publication of the Dyestuffs Division of I.C.I. is No. 8 in the 'Synthetic Resins for Surface Coatings' series. It contains details of the properties of Daltolacs 9, 10 and 11 (polyesters), Suprasecs C, AC, DX, G and K (polyisocyanates) and Suprasec F (a polyisocyanate adduct). Polyurethane surface coatings are formed by reacting one of the Daltolacs with one of the Suprasecs and the publication gives instructions for the preparation of the coatings together with formulations for lacquers for wood, metal and rubber, and a wire enamel. The wood lacquers possess a brilliant gloss and wear extremely well; they are suitable for furniture, wooden floors, laboratory benches, bar tops and TV cabinets. The remarkable film properties of the Daltolac/Suprasec system make it very suitable for the manufacture of stoving and air-drying metal primers and finishes, especially for metals which are normally difficult to coat, such as aluminium and its alloys. Coatings can be formulated for the lacquering of drums, cans, storage tanks and structural metalwork in chemical factories, and for the lining of sea-going tankers. Daltolac 9 is recommended where maximum hardness and resistance to chemical reagents are required. Improved lacquers for rubber, rubberized fabrics and some PVC sheetings can be made with the Daltolac/Suprasec system. The rubber lacquers show good adhesion and gloss, excellent flexibility and a high order of resistance to solvents and chemicals.

Rubber Chem Lines

'Rubber Chem Lines,' August 1959, an organ of the American Cyanamid Co., Rubber Chemicals Department, Bound Brook, New Jersey, US, contains an account of the properties and applications of Cydac, the company's new flaked form of N-cyclohexyl benzothiazole-2-sulphenamide which is creating considerable interest in rubber circles in America. Two examples of stocks in which this accelerator can be used are given—an SBR tread stock and a clay-loaded SBR soling stock.

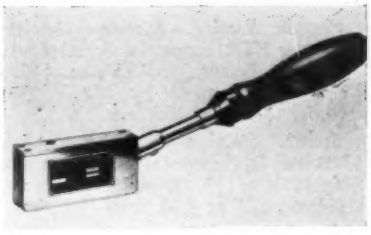
'Marlex'

A new brochure, 'Marlex, Its Growth—Your Opportunity,' illustrating applications and characteristics of the Phillips range of olefine polymers has just been issued by the Phillips Chemical Company of Bartlesville, Oklahoma. This colourful 26-page publication reports on some of the 400-plus 'Marlex' rigid polythene items now in existence since it was first introduced less than three years ago in the shape of an unbreakable, easily sterilizable baby bottle. New applications for ten separate resin types are suggested.

Machines, Materials and Equipment

Plastic Sealing Tool

The 'Hancock Sealer' has been designed to meet the special requirements of plastics sheet sealing. The heating element is controlled by a thermostat which can be adjusted to suit various grades of sheet. Temperatures may be varied from 60°C. (140°F.) to 160°C. (320°F.), and the base of the tool is specially coated to prevent adhesion to the work. Models are available for any voltage up to 250 volts, AC only. The makers are Hancock and Eccles (Electrical) Ltd., of Stourport, Worcs. The price, including 6ft. of 3-coil TRS flexible cable and stand, is £5 5s.



Technical Data

Blends of Neoprene Types WB and GN

The effect of blending Neoprene Type WB with Neoprene Type GN in proportions of 25:75, 50:50 and 75:25 is described in Report BL-354 issued by the Elastomer Chemicals Department, E. I. du Pont de Nemours and Co. (Inc.), Wilmington 98, Del., USA.

The compounds used contained 90 phr of hard clay and data are given for the Mooney scorch value and the extrusion die swell of the stocks as well as for the following properties of the vulcanizates: stress at 500% elongation, tensile strength, elongation at break, hardness and tear strength. The figures for extrusion die swell, tensile strength and tear strength are also shown graphically. Increasing amounts of Type WB give improved extrusion characteristics and this is reflected by a reduction in extrusion die swell. Tensile strength is reduced by blending with Type WB, of Type GN, but even so, a 50:50 Type GN:Type WB blend is 300 psi higher in tensile strength than a comparable 50:50 Type W: Type WB blend. Although blends of Type WB and Type GN appear to be more attractive from a tensile and tear strength standpoint than similar blends of Type WB and Type W, consideration should be given to the effects on other physical properties. Colour, heat resistance and compression-set resistance (particularly in compounds containing carbon black) will be adversely affected by the presence of Type GN.

Modifying Agent for Epoxy Resins

Abrac 'A,' an epoxidized oil, can be used as a partial replacement for conventional epoxy resins prior to curing. The resultant modified resins have greater toughness and resilience, improved resistance to low-temperature embrittlement and good adhesion to metal, while the cost is reduced. Data for the properties of Abrac 'A' and information on its use in (a) anhydride-cured resins, and (b) amine-cured resins are given in Advance Technical Information Sheet 1023 issued by A. Boake, Roberts and Co. Ltd., Abrac Works, London, E.15.

In epoxy resin systems cured with phthalic anhydride, up to 70% of the epoxy resin may be replaced with Abrac 'A.' The degree of resilience of the cured resin increases with the increase in content of Abrac 'A,' until at the higher concentrations, soft, flexible rubbery compounds are formed. Data for the modulus of a series of compounds show the change which occurs. The factors to be considered in the modification of systems of this kind are the concentration of Abrac 'A' and of phthalic anhydride and the curing cycle. The incorporation of Abrac 'A' into amine-cured epoxy resin systems provides similar modifying effects although difficulties occur because of the tendency towards preferential reaction of the amine with the epoxy resin rather than with the epoxidized oil. The reactivity of different commercial amine-curing agents also varies and in many cases the amines show little tendency to react with Abrac 'A' except at elevated temperatures. It is therefore necessary to ascertain whether Abrac 'A' can be satisfactorily incorporated into the system and, if so, the best procedure. A convenient method of introducing Abrac 'A' is to use an Abrac 'A'/polyamine adduct as the curing agent and particulars are given of three of these adducts, namely ECP/308, ECP/309 and ECP/365. Typical formulations of epoxy resin with each of the adducts are included.

Faster Curing Butyl

LONDON SECTION IRI MEETING

THE Production and Properties of Faster Curing Butyl Rubbers was the subject of a paper by Z. J. Dorko, B.Sc., D. C. Edwards, B.Sc., and P. B. Lumb, M.A., B.Sc., D.Phil., of the Polymer Corporation, Sarnia, Canada, presented by Dr Lumb at the meeting on October 6 of the London Section of the Institution of the Rubber Industry. A large number of members gathered to hear the lecture, which is summarized below.

The paper outlined the problems associated with the production of faster curing Butyl polymers, which still retained the practical advantages of this type of rubber. A solution to these problems was discussed which had led to the commercial production of such rubbers by Polymer Corporation.

The properties of these new rubbers were then discussed in comparison with existing grades as a means of illustrating the range of behaviour now available. Particular attention had been placed on ageing studies in both reinforced and gum vulcanizates, and from these studies, explanations were offered for the differences in behaviour of vulcanizates cured in sulphur, quinoid and resin systems.

These comparisons suggested practical advantages for the new rubbers in applications where the useful characteristics of conventional Butyl rubber were required in conjunction with higher states of cure and faster cure rates.

At the end of the meeting, members of the London Section, friends and guests were entertained to a cocktail party given by the Polymer Corporation.

A more detailed report of the paper will be published in *RJIP* for October 24.

J. Stopforth

The death took place on Monday October 5 of Mr J. Stopforth, a director of the Leyland and Birmingham Rubber Co. Ltd., Leyland, Lancashire. He was 58. Mr Stopforth, who had been with the company for 44 years, was personnel manager for 25 years and a director since 1951.

A founder member of the Preston section of the Institution of the Rubber Industry, Mr Stopforth was a past chairman of the section and had been secretary for many years. He was a member of the Institute of Personnel Management and served on the local National Insurance Advisory Committee.

Future Events

INSTITUTION OF THE RUBBER INDUSTRY

Leicester Section.—Friday October 16 at the Bell Hotel, Leicester, at 7.30 p.m. 'Developments in the Technology of Direct Moulded Footwear Processes,' by Mr C. E. Webb, B.Sc., A.R.I.C., A.I.R.I., C. and J. Clark Ltd.

Midland Section.—Monday October 12 in the Council Chamber, Fort Dunlop, Birmingham, 24, at 6.45 p.m. 'Rubber in Civil Engineering' (with film) by Dr A. N. Gent (BRPRA).

Merseyside Section. — Wednesday October 14 at the Central Libraries, William Brown Street, Liverpool, at 7.30 p.m. Joint meeting with Liverpool Technical Library. 'Tyres and the Modern Car,' by Mr E. S. Tompkins, B.Sc., A.R.P.S., A.I.R.I., Dunlop Rubber Co. Ltd.

Manchester Section. — Thursday October 15 at the Midland Hotel, Manchester, at 6 p.m. 'A Quantitative Ozone Test for Small Specimens,' by Mr D. C. Edwards and Mr E. B. Storey. The paper will be read by Dr P. B. Lumb of the Polymer Corp. Ltd.

Preston Section.—Monday October 12 at the BTR Industries Social Club, Farington, Preston, at 7.15 p.m. 'Silicones in Industry,' by Mr R. W. Douglas (Midland Silicones Ltd.).

Scottish Section.—Tuesday October 13 at the Institution of Engineers and Shipbuilders, 39 Elmbank Crescent, Glasgow, C.2, at 7.30 p.m. '18 Years' Progress with Polysulphides,' by Mr W. H. Stevens, A.R.C.S., F.R.I.C., F.P.I., F.I.R.I.

PLASTICS INSTITUTE

Midland Section.—Friday October 16 at the James Watt Memorial Institute, Great Charles Street, Birmingham 3, at 6.30 p.m. 'Dough Moulding Compounds,' by N. A. Cutler, B.Sc., Ph.D., BIP Chemicals Ltd.

North-Eastern Section.—Wednesday October 21 in the Second Dining Room of the Eldon Grill, Grey Street, Newcastle-upon-Tyne, at 7 p.m. 'Molecular Structure and the Properties of Plastics,' by A. W. Birley, Ph.D., Imperial Chemical Industries Ltd.

Plastics and Polymer Group, Society of Chemical Industry. — Thursday October 22 at the Royal Institution, 21 Albemarle Street, London, W.1, at 6.30 p.m. The Fourth Baekeland Memorial Lecture. 'Recent Progress in Polymer Chemistry,' by Prof. H. Mark, Polytechnic Institute, Brooklyn.

Scottish Section. — Wednesday October 21 at More's Hotel, Glasgow, at 7.30 p.m. 'Works Study,' by P. A. Kirtley, Rolls Royce Ltd.

South Wales and Monmouthshire Section.—Wednesday October 7 at the King's Head Hotel, Newport, Monmouthshire, at 7 p.m. 'Hydrocarbon Polymers,' by Prof. C. E. H. Bawn, C.B.E., B.Sc., Ph.D., F.R.S., Liverpool University. Joint meeting with the South Wales Section of the Plastics and Polymer Group, Society of Chemical Industry.

Western Section.—Wednesday October 21 at Gloucester Technical College at 7 p.m. 'Polyurethane Foams,' by Dr J. F. Wood and Mr E. A. Packer.

Yorkshire Section. — Wednesday October 21 at St. Mark's House, 186 Woodside Lane, Leeds 2, at 7.15 p.m. Ladies' Night. 'Furs,' by E. Salsbury, Heatonia Fur Co. Ltd.

EXHIBITION

The Dusseldorf Plastics Exhibition opens on October 17 to run until October 25.

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

COMET (787,047) For artificial precious stones and beads being imitation jewellery made of glass or of plastics. By Wilhelm Swarovski, Fritz Swarovski, Alfred Swarovski, Daniel Swarovski, Manfred Swarovski and Robert Frey trading as D. Swarovski and Co., Wattens, Tyrol, Austria. Address for service is c/o Wheatley and Mackenzie, 19-23 Ludgate Hill, London, E.C.4. (Class 4; August 12 1959.)

SILVERFLOW (787,573) For pipes, tubes and fittings therefor, all made of plastics and included in Class 17. By B.T.R. Industries Ltd., Herga House, Vincent Square, London, S.W.1. (Class 17; August 12 1959.)

NICARON (787,949) For thermo-setting synthetic resin plastics included in Class 17 in the form of sheets or plates. By Rheinische Gummi-Und Celluloid-Fabrik, Mannheim-Neckarau, Germany. Address for service is c/o Reginald W. Barker and Co., 13 Charterhouse Square, London, E.C.1. (Class 17; August 12 1959.)

HOTFALT
BITUMINOUS COMPOUND

(73,976) For thermo-setting bituminous compounds (not in the nature of paint) for use in road making. By C. R. Berrett and Co. Ltd., Wilton Goods Sidings, Southern Railway, Wilton, near Salisbury, Wiltshire. To be associated with No. 526,057 (2797, 1469). (Class 19; August 12 1959.)

NEW COMPANIES

Plastic Merchants Ltd. (630,981).—June 23. Capital: £100 in £1 shares. The first directors are: Herbert D. W. Stevens and Ethel Stevens, Scotland Cottage, Orchard Lane, Hassocks, and Kenneth J. Bull, 28 Hollingbury Place, Brighton. Regd. office: 47 Church Road, Burgess Hill.

K. D. Tharme and Co. Ltd. (628,945).—May 27. Capital: £100 in £1 shares. To carry on the business of manufacturers of and dealers in sponge, rubber, soft, natural and synthetic rubber, plastics, etc. The directors are: Kenneth D. Tharme, 17 Beaufort Road, Gravelly Hill, Birmingham, 23, and Frederick E. Simpson, 27 Goldieslie Road, Sutton Coldfield, directors of Engineering Concessionaires Ltd. Regd. office: 93a Station Street, Birmingham, 5.

General Ceylon (Holdings) Ltd. (633,000).—July 17. Capital: £100 in 10s. shares. To acquire the whole or any part of the issued share capital undertaking, property and assets of General Ceylon Rubber and Tea Estates Ltd., etc. The subscribers (each with one share) are: F. A. Bourne and J. W. Laurie, both of 4 Lloyds Avenue, E.C.3, company directors. The first directors are to be appointed by the subscribers. Solicitors: Stephenson Harwood and Tatham, Saddlers Hall, Gutter Lane, E.C.2.

R.J.I.P.

ANNUAL EXPORT NUMBER

will be published next week and, owing to increased size, will close for press earlier than usual. All Classified advertisements for this edition should reach this office not later than first post MONDAY OCTOBER 12.

Rubber Journal and International Plastics

CLASSIFIED ADVERTISEMENTS

MISCELLANEOUS

6d. a word, Minimum 12/6 **Box 2/-**

'COTSWOLD' dipping machines and circulating tanks for latex and PVC. New catalogues now available on request.—Lionel Hook and Sons, Ebley, Stroud, Glos. Tel.: Stonehouse 614/5. (380)

MANUFACTURERS of roughing machines for rubber sheeting, sponge rubber, splitting machines, leather cloth plant, embossing plates and rollers, spreading machines and presses.—G. L. Murphy, Ltd., Imperial Works, Menston, Nr. Leeds. (238R)

APPOINTMENTS VACANT

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FLOORING technologist required for development work on Vinyl flooring by public company situated north of Manchester. Applicants must have wide experience in this field.—Apply in confidence, giving details of age, experience, education and salary required to Box 225. (225)

MILL foreman with sound knowledge of rubber technology to understudy and eventually to succeed experienced mill manager. Good salary and conditions with a progressive well-established company.—Write giving particulars of age, career to date and present position to The St. Albans Rubber Co., Ltd., The Camp, St. Albans, Herts. (234)

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who must be fully qualified and experienced in the rubber and plastics industries, to work directly under the General Manager at their Wellingborough factory. This is a top-level appointment for a man of high calibre possessing appropriate qualifications, including experience of modern production methods and handling of labour.

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Write in complete confidence, giving fullest commercial and personal particulars and salary required, to the Deputy Managing Director, Rilex House, Chandos Street, London, W.1. (226)

APPOINTMENTS VACANT

(continued)

PRODUCTION control. Rubber manufacturers in South-West London invite applications from suitably qualified and/or experienced men for a position in production control. Shop floor experience in one or two of the following is essential: 1, Moulded mechanicals; 2, millroom and calendering; 3, hand fabricating of G.R.G. The appointment is permanent, progressive and pensions facilities are available. The salary will be commensurate with qualifications and experience.—Apply giving full details to Box 230. (230)

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RUBBER IMPROVEMENT LIMITED
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for their Reinforced Plastics Division manufacturing Glass-fibre sheetings on the most modern continuous plant. Applicants must be fully experienced and have sound practical knowledge of glass-fibre products, polyester and epoxy resins and machine or hand-lay production of transparent sheet. Knowledge of modern production methods and handling of labour essential.

Non-contributory pension and life insurance schemes operate.

Write in confidence, giving fullest commercial and personal particulars and salary required, to the General Manager. (228)

RUBBER IMPROVEMENT LIMITED
WELLINGBOROUGH

require

DEPARTMENTAL MANAGER

for their Flooring Division which manufactures Thermo-Plastic, Vinyl and Vinyl-Asbestos Floorings. Applicants must be fully experienced in these products. Knowledge of modern production methods and handling of labour essential.

Non-contributory pension and life insurance schemes operate.

Write in confidence, giving fullest commercial and personal particulars and salary required, to the General Manager. (227)

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K4 INTERMIX with 110 h.p. drive and conveyor. 84in. single geared mill by Bridge, with motor drive. 450-ton 8-daylight press by Shaw, platens 36in. x 30in.; 24in. diameter ram.—Reed Brothers (Engineering) Ltd., Replant Works, Woolwich Industrial Estate, London, S.E.18. Telephone: Woolwich 7611/6. (235)

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AGENCIES and REPRESENTATIVES

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VITAFOAM LIMITED require the services of a full-[illegible] representative for the Midland area. Applicants should have established contacts with the Upholstery trade in this area. Reply in confidence giving particulars of age, experience, etc., to the Upholstery Sales Manager, Vitafoam Limited, Don Mill, Don Street, Middleton, Nr. Manchester, Lancashire. (2[illegible])

PATENTS

6d. a word, Minimum £1. Box 2/-.

THE proprietor of British Patent No. 695049, entitled "Improvements in snow and ice tires" offers same for license or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern and Carlberg, 14 E. Jackson Blvd., Chicago, 4, Illinois, U.S.A. (3[illegible])

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